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April 1961

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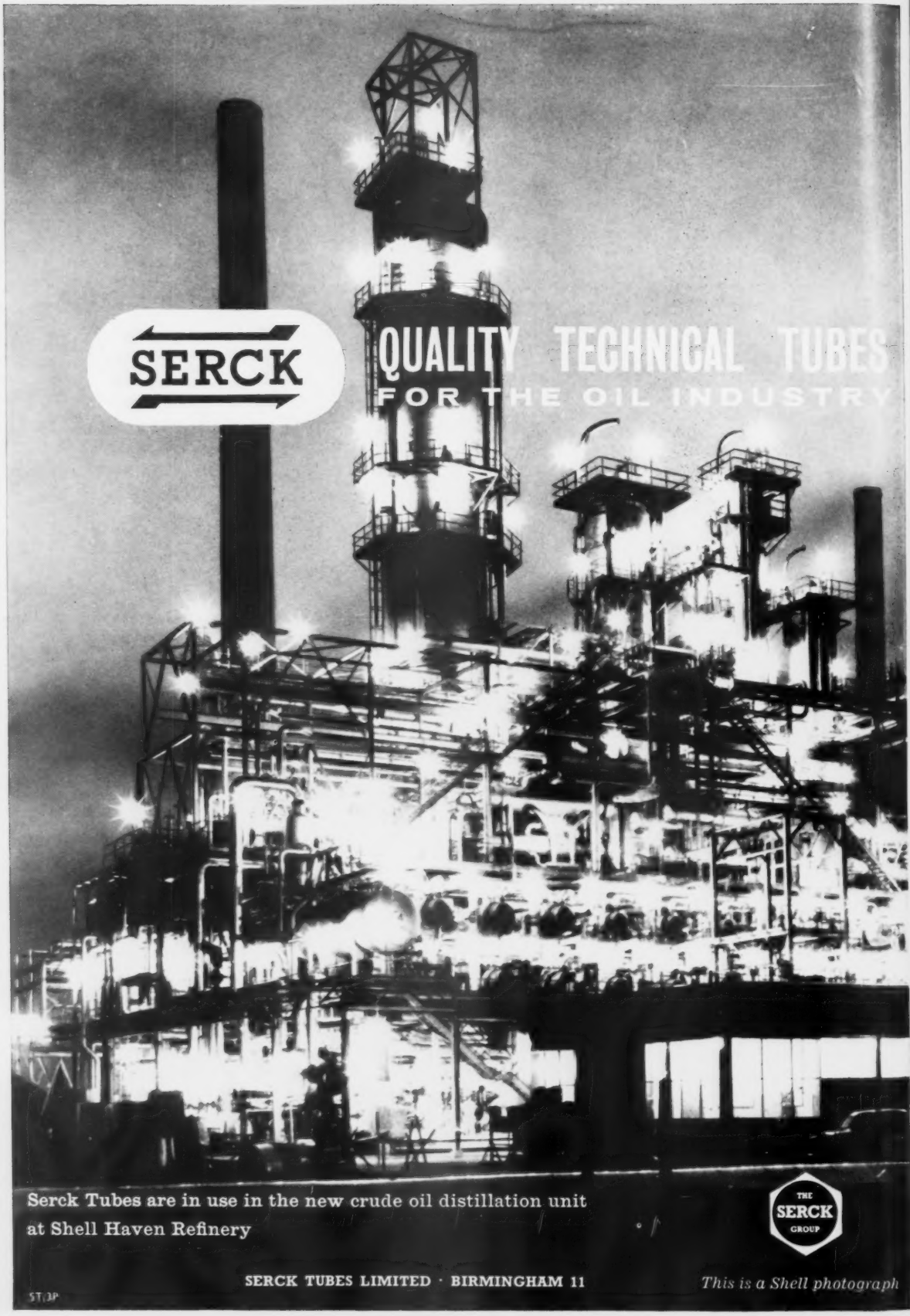

Serck Tubes are in use in the new crude oil distillation unit at Shell Haven Refinery

THE SERCK GROUP

SERCK TUBES LIMITED · BIRMINGHAM 11

This is a Shell photograph

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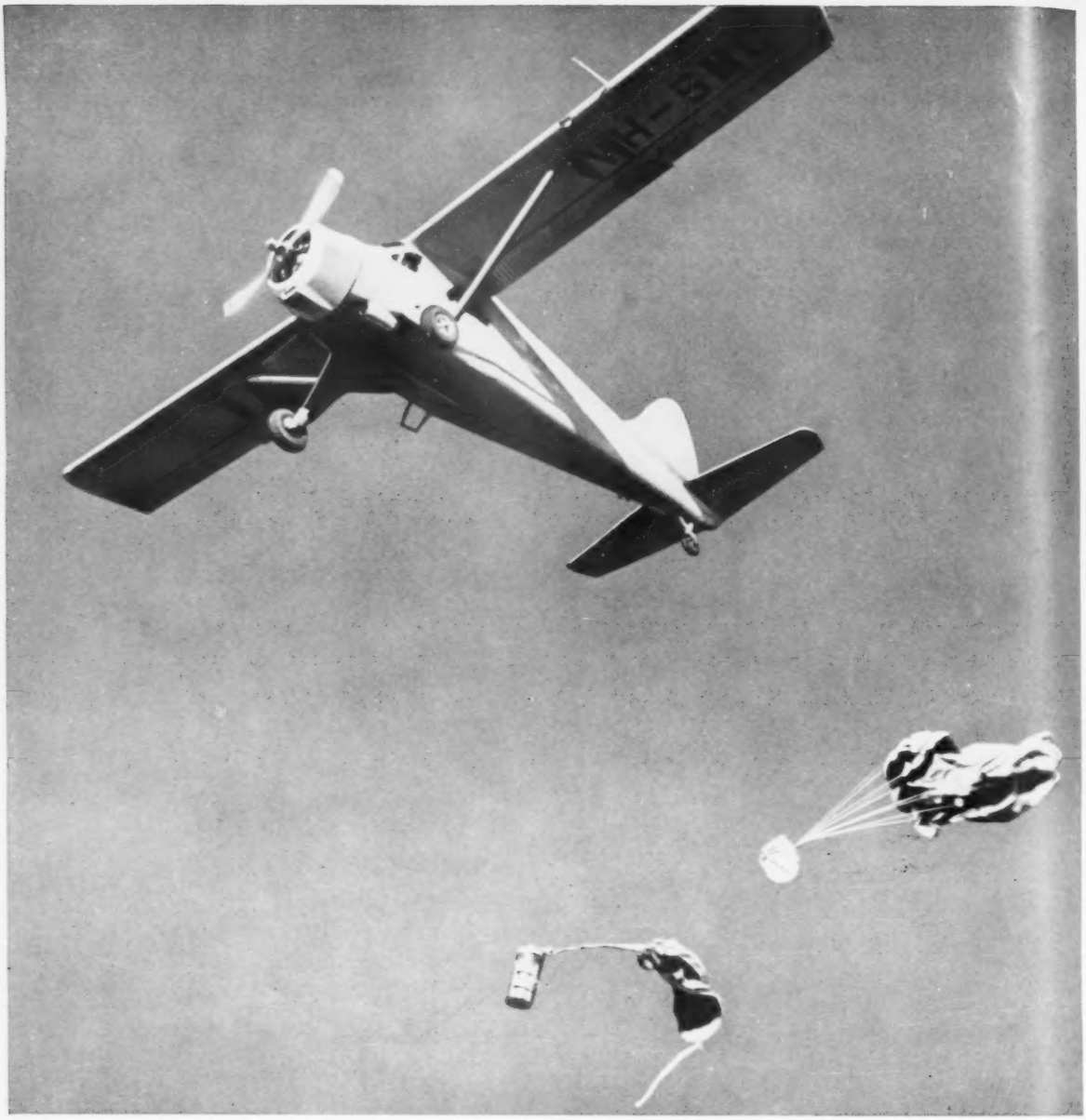


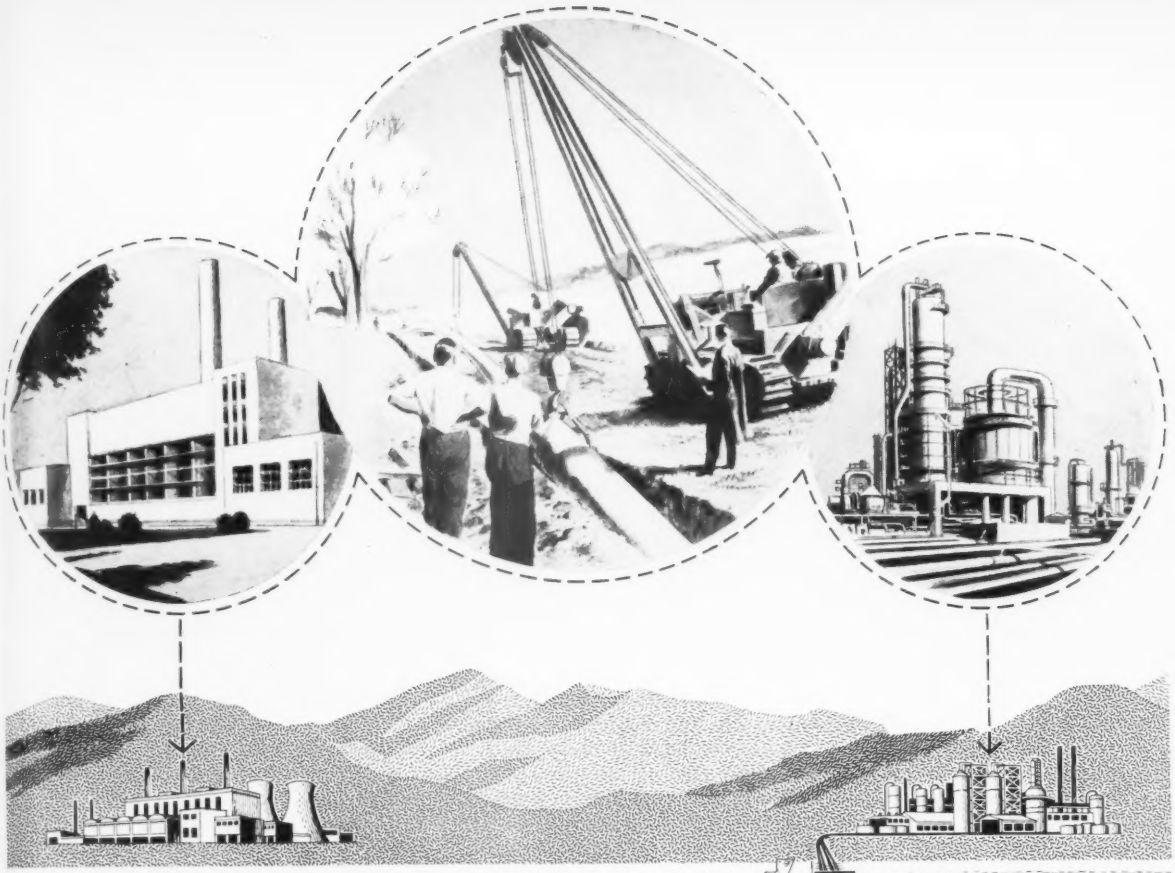
Airlift Australia

AUSTRALIA'S Snowy Mountains Scheme has presented some unusual challenges to BP as sole supplier of petroleum products. Some of these challenges have been met in unusual ways, such as fuel drops from aircraft.

This gigantic project, midway between Sydney and Melbourne, with its great dams, power stations, and miles of tunnels and aqueducts, is designed both to provide hydro-electricity and to divert irrigation water westwards into the parched plains.

British Petroleum is proud to be associated with the Snowy Mountains Scheme, one of the world's greatest engineering undertakings.

BP



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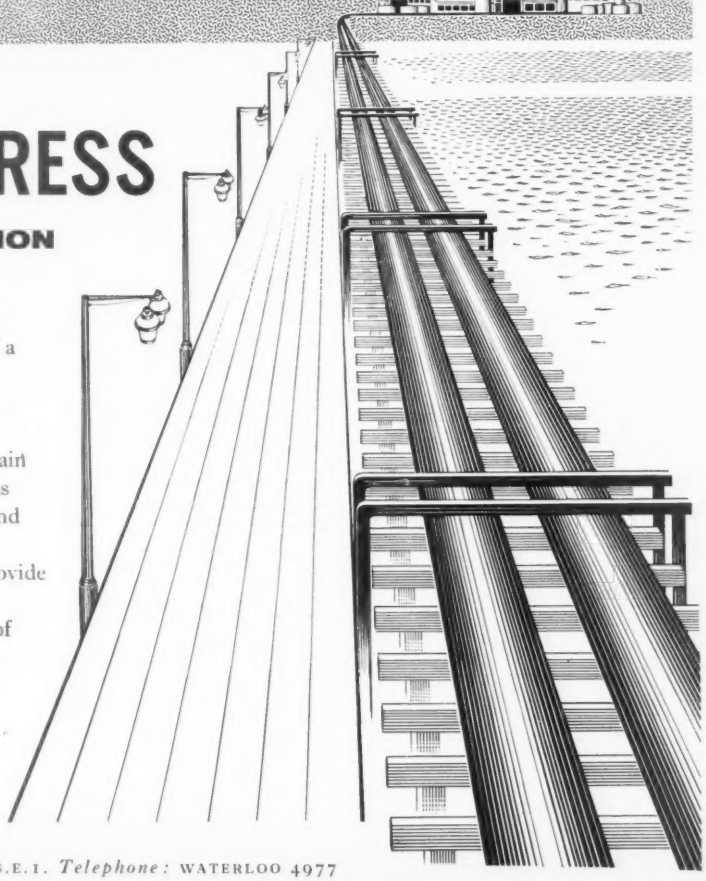

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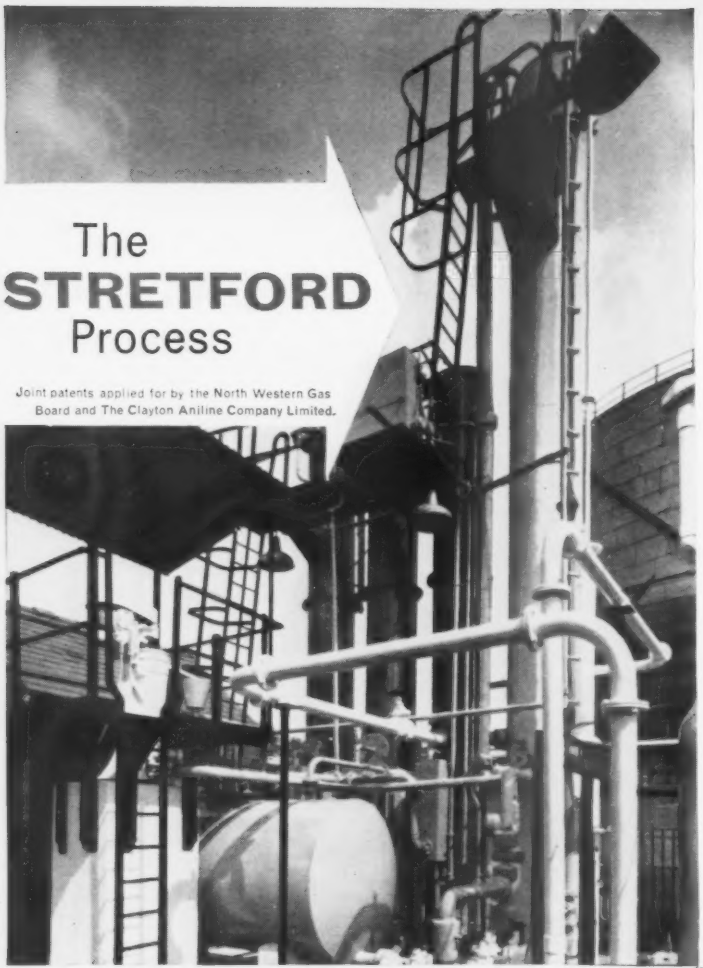
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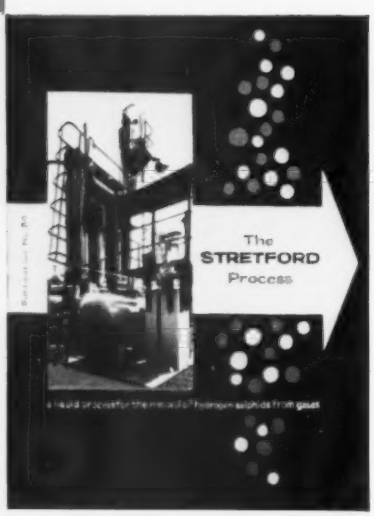

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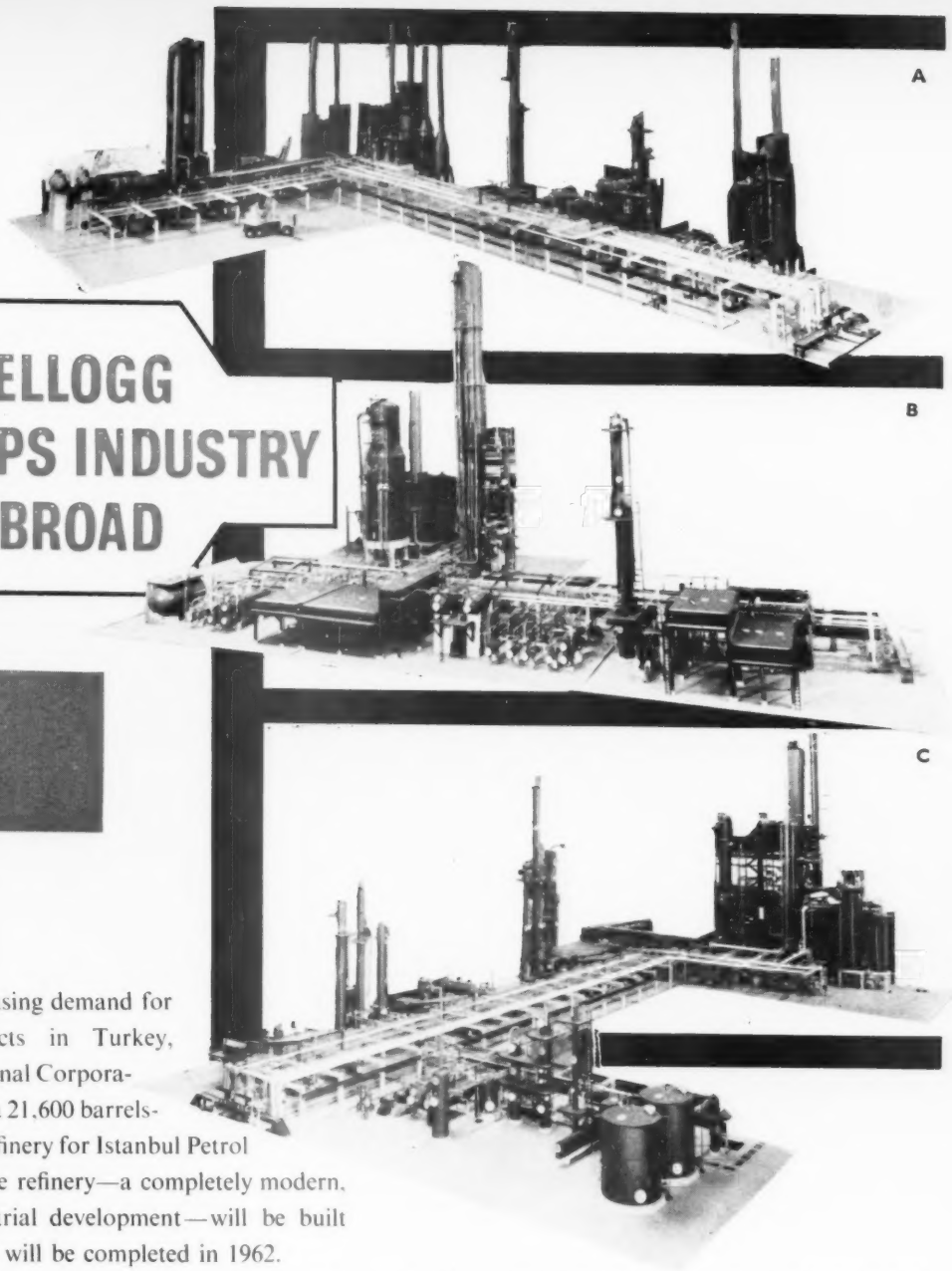

To meet the increasing demand for petroleum products in Turkey, Kellogg International Corporation has designed a 21,600 barrels-per-stream-day refinery for Istanbul Petrol Refinerisi A.S. The refinery—a completely modern, grass roots industrial development—will be built near Istanbul and will be completed in 1962.

The world-wide Kellogg organization is responsible for the design, engineering, procurement of materials and equipment, and will supervise construction in Turkey. The project consists of five processing units and utility facilities. Products will be petrol, LPG, illuminating kerosine, motor diesel and heavy fuel oil.

Shown above are design models of the A, B, and C units of The Istanbul Petrol Refinerisi A.S.

If you are planning to build new industry at home or abroad, Kellogg International Corporation would be pleased to show you how its co-ordinated engineering-procurement-construction service can work to your company's economic advantage.

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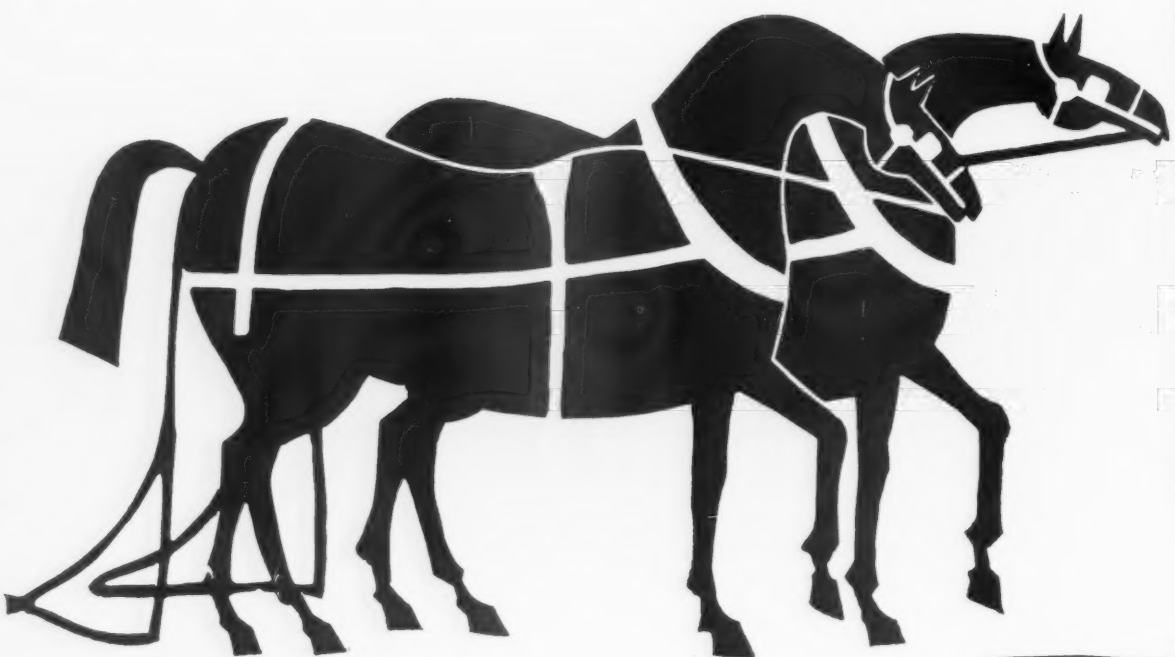
We have seen some changes since our early days, when the oil industry's biggest market was for lamp oil and harness oil. In the first six decades of this fantastic century we have produced petroleum fuels and lubricants for an unimaginable variety of machines throughout the world. Now, in the dawn of the space-age, we are already lubricating the world's first atomic submarine and the giant turbine generators of Kariba Dam. What strange new needs shall we have to meet tomorrow? There is really no knowing–but we shall be ready for them, whatever they are. The oil industry does not keep progress waiting.

WHEREVER CHANGE MAY LEAD



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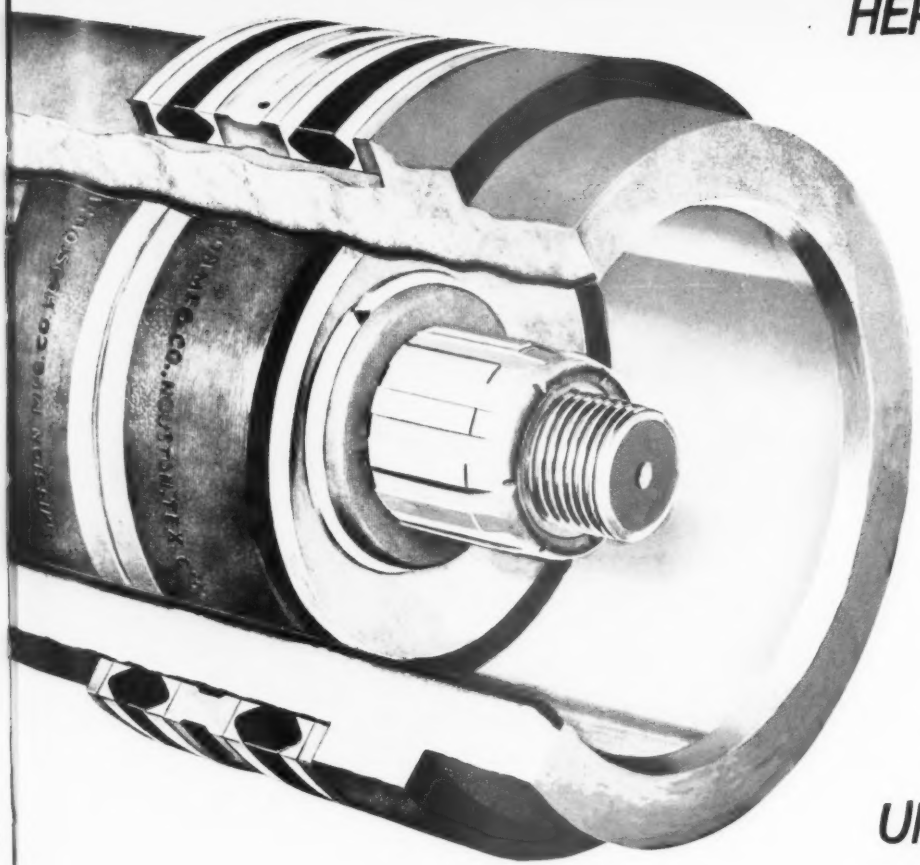

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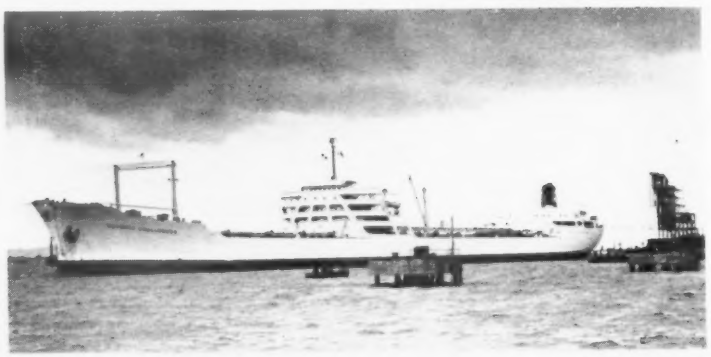

Europe's largest independent Oil Storage Installation with Storage Capacity of 1,800,000 tons

Illustration shows 65,000 ton tanker OLYMPIC CHALLENGER approaching No. 10 Jetty at Thames Haven on March 1st, 1960, to discharge her cargo of Kuwait crude oil. The OLYMPIC CHALLENGER is the largest ship ever to sail up the River Thames.

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Dave Davies and Les Brown head the Birfield-Hilco oil filtration team—the only one of its kind and calibre in Britain.

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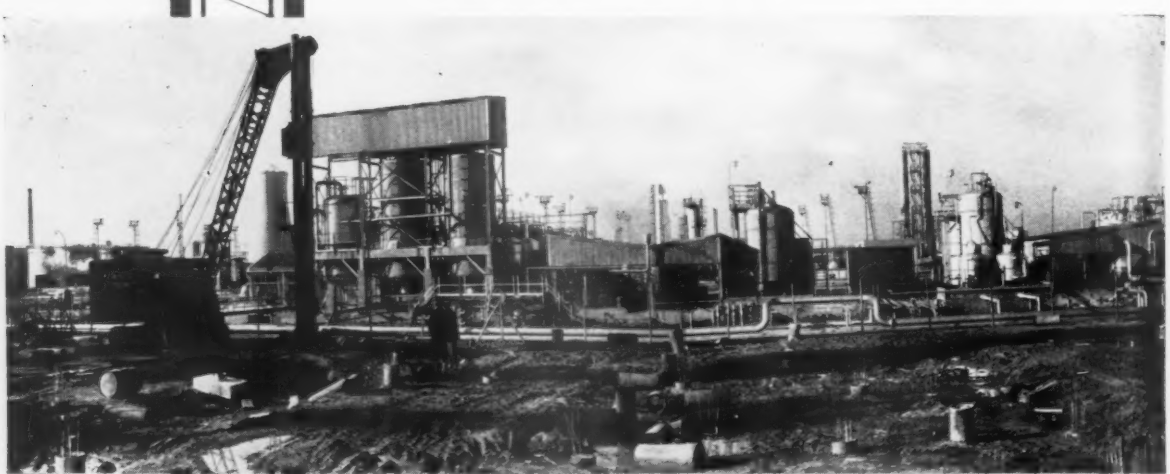
refinery foundations

This mobile piling machine is driving 14½ in. dia. West's Shell Piles to support the foundations of the Predistillation Plant at the B.P. Refinery on the Isle of Grain. Since this important site was first developed more than 11,600 West's Shell Piles have been driven to support many different items of refinery plant and equipment.

West's Shell Piling System, which combines a pre-cast sectional outer shell, driven to a firm "set" in the load-bearing stratum, with a reinforced concrete core cast after driving is completed, has also been used for the foundations of petroleum and allied plant at refineries and storage installations in various parts of the country, including Fawley, Thames Haven, Belvedere, King's Lynn, Partington, Grangemouth and Avonmouth.



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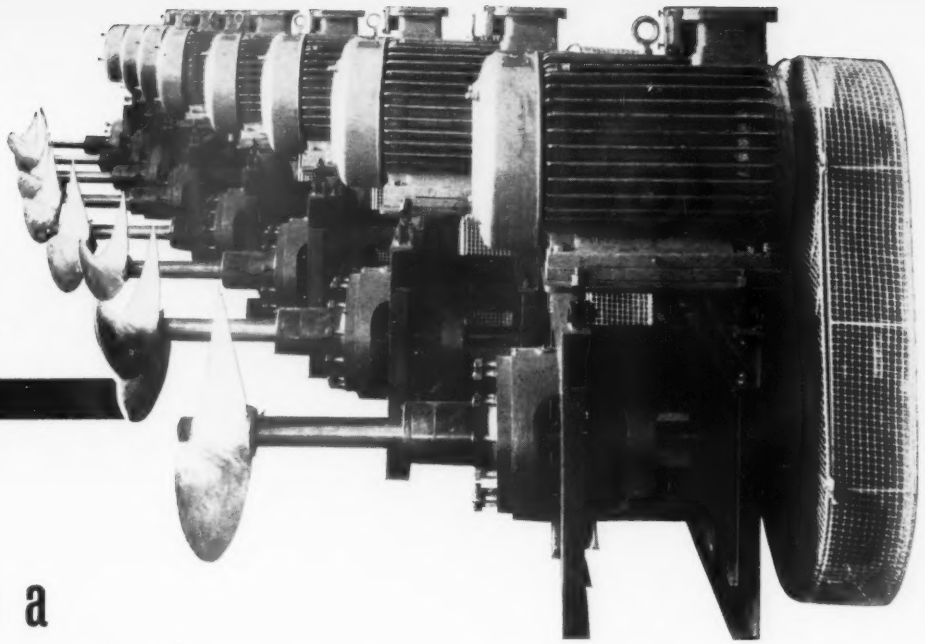

Battery of large Side-entry Petroleum blending agitators for despatch to a Middle East Refinery.

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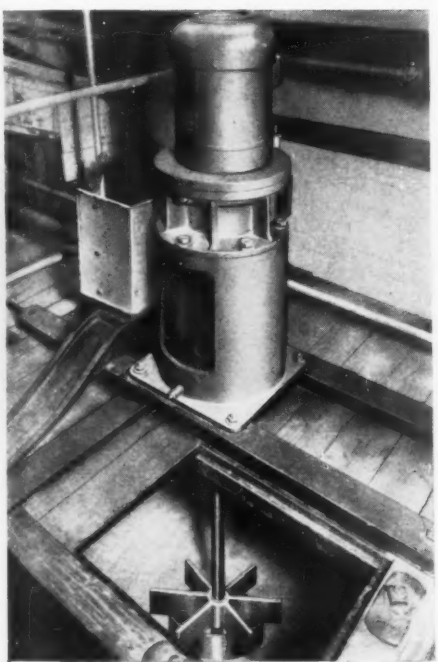
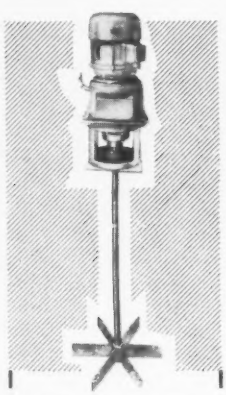
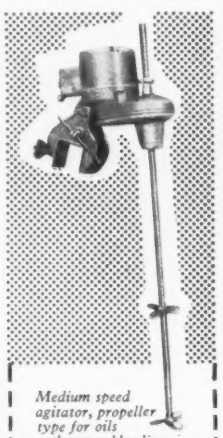


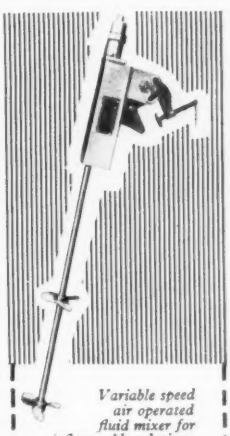
GVD type medium speed fluid mixer fitted with open type turbine impeller and stabiliser ring for oil and grease blending and for the inclusion of additives into lubricating oils.



Heavy duty 460 r.p.m. permanently mounted fluid mixer with turbine impeller.



Medium speed agitator, propeller type for oils and grease blending.



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Painted by Derek Hyatt

Shell guide to LANCASHIRE

Fell and plain, empty and populated, quiet and active, lake and sea, bare and intimately rich, ancient and very modern, ruin and factory, coal and honeysuckle, dirt and lake'and purity, English and Norwegian (on a Roman and British foundation) — has any other county more contrasts and contradictions, more of prose and poetry? Southerners think of Manchester and Lancaster and forget they were Roman (the "fort at Mamucion", the "fort on the Lune"), think of ships and coal, and forget that Lancashire includes some of the best scenery of the Lakes — and so of Europe. They hear Lancashire speech, and do not realize it unites Lancashire to the fjords. They think of textiles and mill girls, not realizing that Lancashire's textile interest began with the Cistercian monks of Furness Abbey (1), below the fells which were the monastic sheep walks. If they remember Arkwright (born at Preston in 1732), who invented the spinning frame, or recall that the Liverpool and Manchester Railway, which was opened on 13 September, 1830, and for which Stephenson built his *Rocket* (2), was the first public railway in the world, they should also recall John Ruskin (3) (1819-1900) writing and arguing for a better society in his Lakeland home on Coniston Water, or that George Stubbs (1724-1806), grand and severe painter of horses (4), portraits and landscapes, was born and bred in Liverpool. "Bleakish, but solemn and beautiful", the poet Hopkins wrote of the fell and valley land near Stonyhurst, pondering its bluebells and brilliant leaves and flowers of wild garlic (5). Lancashire is both the wind-bent tree and the cheerfulness of Lancashire Hot Pot or Eccles cakes (6), both the black fell (an old Norse word) and that famous symbolic Red Rose of Lancashire (7), which by origin was the old *Rosa gallica*.

The "Shell Guide to Wild Life", a monthly series depicting animals and plants in their natural surroundings, which gave pleasure to so many people, is published in book form by Phoenix House Ltd at 7/6. The "Shell Guide to Trees" and "Shell Guide to Flowers of the Countryside" are also available at 7/6 each. On sale at bookshops and bookstalls.

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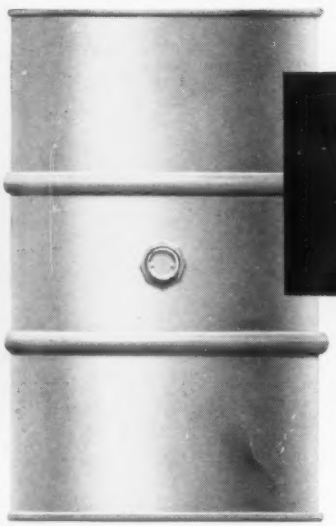

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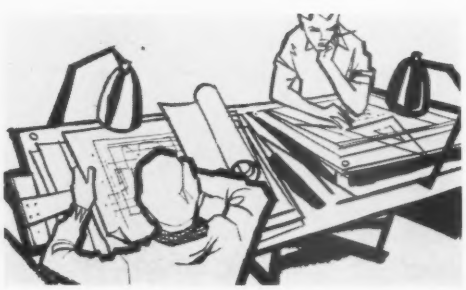

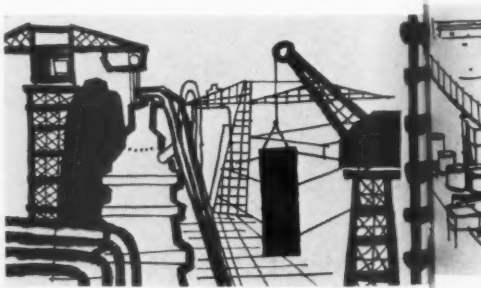

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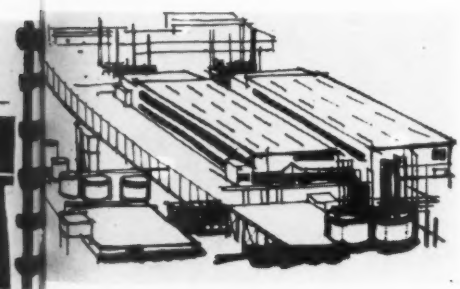

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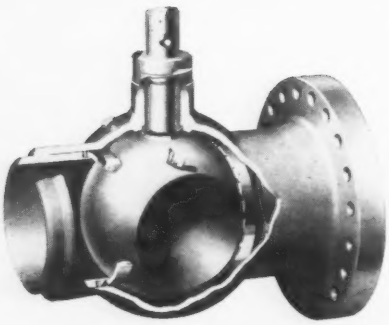
SAY GOODBYE TO VALVE REPAIR



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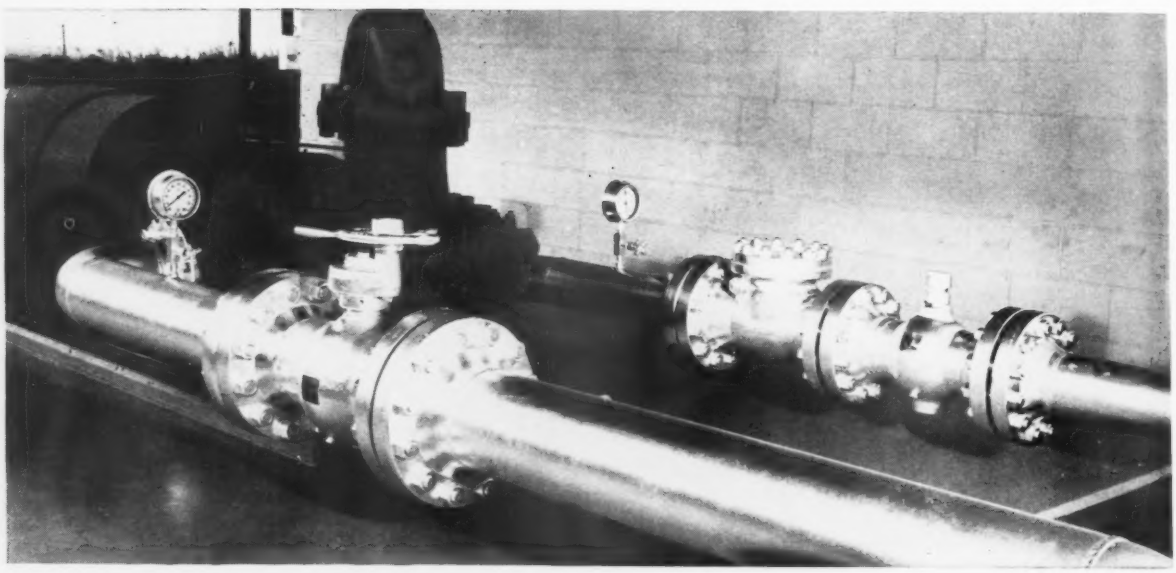

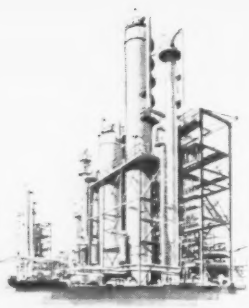

Rotation of the seats distributes this wear equally over the entire sealing surface and extends the life of the valve many times over valves with stationary sealing surfaces.

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THE INSTITUTE OF PETROLEUM
REVIEW

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Honorary Editor: E. B. EVANS, M.Sc., PH.D., F.R.I.C. *Hon. Associate Editor:* D. L. SAMUEL, B.Sc., A.R.I.C. *Editor:* M. J. WELLS

The Annual Dinner

With some 1500 guests filling it to capacity, the Great Hall at Grosvenor House made a splendid setting for the Annual Dinner of the Institute of Petroleum on the evening of 22 February. With the guests of honour, General Sir Brian Robertson, Bt, G.C.B., G.B.E., K.C.M.G., K.C.V.O., D.S.O., M.C., and S. P. Chambers, C.B., C.I.E., chairman of Imperial Chemical Industries Ltd, seated either side of him, the gathering was presided over by the President of the Institute, Julian M. Leonard.

The official guests included H. D. Acres (*chairman, Regent Oil Co. Ltd*); N. P. Biggs (*managing director, Esso Petroleum Co. Ltd*); H. A. R. Binney, C.B. (*director, British Standards Institution*); The Hon. M. R. Bridgeman, C.B.E. (*chairman, The British Petroleum Co. Ltd*); Dr J. Burns (*president, Pipeline Industries Guild*); M. Flett, C.B. (*Deputy Secretary, The Ministry of Power*); J. C. Gridley, C.B.E. (*chairman, Mobil Oil Co. Ltd*); W. M. Heynes (*chairman, Automotive Division, The Institution of Mechanical Engineers*); W. K. Hutchinson, C.B.E. (*president, The Institution of Chemical Engineers*); Mr G. R. Jacobs, (*Petroleum Attaché, The Embassy of the United States of America, London*); E. G. C. Mardall (*general manager, Lobitos Oilfields Ltd*); Air Marshal Sir Walter Merton, K.C.B., O.B.E. (*Air Member for Supply and Organization*); The Rt Hon. The Viscount Monckton of Brenchley, P.C., K.C.M.G., K.C.V.O., M.C. (*chairman, Iraq Petroleum Co. Ltd*); R. Navarre (*director, Institut Français du Pétrole*); Sir William Ogg (*late director, Rothamsted Experimental Station*); Sir Dennis Proctor, K.C.B. (*Permanent Secretary, The Ministry of Power*); H. W. Rocke (*managing director, Mobil Oil Co. Ltd*); H. E. Snow, C.B.E. (*deputy chairman, The British Petroleum Co. Ltd*); K. L. Stock, C.B. (*Under-Secretary, The Ministry of Power*); J. M. Storey, C.B.E. (*chairman, Council of British Manufacturers of Petroleum Equipment*); W. C. Townsend (*managing director, Caltex Trading and Transport Co. Ltd*); R. E. F. de Trafford, O.B.E. (*Manchester Oil Refinery (Holdings) Ltd*); H. Vautrin (*president, Association Française du Techniciens du Pétrole*); Vice-Admiral J. M. Villiers, C.B., O.B.E. (*The Fourth Sea Lord*); Sir Walter Warboys (*chairman, B.T.R. Industries Ltd*); H. Wilkinson, C.M.G. (*managing director, The Royal Dutch-Shell Group of Companies*).

Also present was the immediate past-president of the Institute of Petroleum C. M. Vignoles, C.B.E., together with past-presidents E. A. Evans, Professor F. H. Garner, O.B.E., and The Rt Hon. Lord Geddes, C.B.E., D.L. Vice-presidents C. Chilvers, T. W. Mathias, O.B.E., and J. S. Parker were also among the gathering. Members of Council included W. S. Ault, A. J. Foster, Dr T. F. Gaskell, Sir Stephen Gibson, C.B.E., R. H. W. Hamilton, M. E. Hubbard, W. E. Madden, W. H. Thomas, G. A. Dickens (*hon. secretary*), O. F. Thompson, O.B.E. (*hon. treasurer*), and Dr E. B. Evans (*hon. editor*).

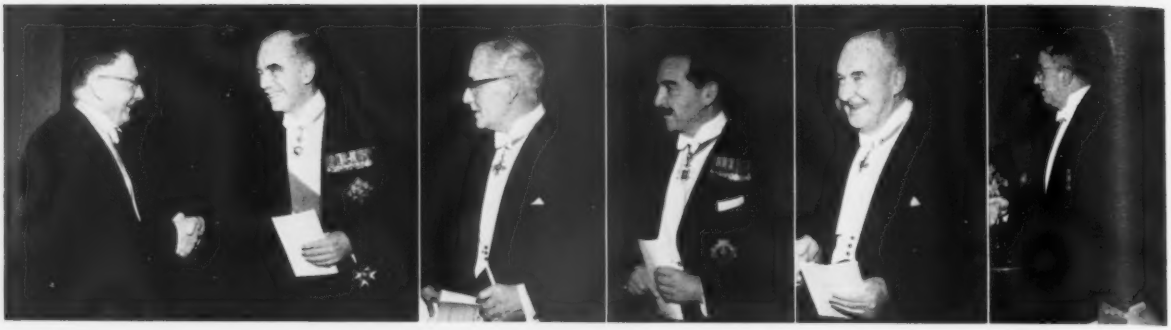
The President (right) chats to Sir Brian Robertson (left) and Lord Monckton

The Institute and the Petroleum Industry

General Sir Brian Robertson proposed the toast of the Institute and the Petroleum Industry.

After recounting some of his experiences with petroleum supply during the war he continued as follows.

In 1950 I was made Commander-in-Chief in the Middle East and found myself immediately closely involved in the problems created by the very rapid expansion of the oil industry in that part of the world. This was the time of the Abadan crisis, of the



The President greets some of the guests. General Sir Brian Robertson, J. C. Gridley, Air Marshal Sir Walter Merton, C. M. Vignoles, and H. Vautrin

exploitation by Tapline in Saudi Arabia, of the phenomenal developments in Kuwait. It was also, I am afraid, a time when rivalries for the control of oil supplies were allowed to disturb the unity of Anglo-American purpose. I am speaking of a time ten years ago and more. I looked at the picture then quite frankly through British eyes. We can now view it in calm perspective, as well as in the light of the very changed situation in the Middle East which is, in large degree, a consequence of what happened then. It is of little interest now to argue about who was to blame. We shall do better, both of us, to imbibe the stern lesson that in these modern times the Western nations cannot on any account allow their economic and commercial rivalries to sap the foundations of their political concord.

Another aspect of those developments in the oil industry which impressed me greatly was the effect upon the countries of the Middle East of a sudden accession of wealth. I had more than one conversation in those days on this topic with that very remarkable man, King Ibn Saud of Saudi Arabia. He was very concerned about it and during the last years of his life he worked hard to ensure that this new found wealth should not be allowed to corrupt the ancient traditions of courage and simple living of his subjects, nor especially to weaken their faith. Sudden wealth can be a very dangerous thing either to an individual or to a nation.

Three years later I came to the Transport Commission and I was soon told that the interests of the petroleum industry were completely opposed to those of the railways. A great deal has happened since then and my personal opinion is now quite the opposite. So far from being in separate camps we are partners in locomotion. The railways are now using more than 70 million gallons of diesel oil a year for traction purposes, and this consumption is likely to rise to something like 170 million gallons by the end of 1964. They use another 10 million gallons of diesel oil and motor spirit for their road delivery services (also likely to increase) and 50 million gallons of heavy fuel oil in their workshops. London Transport and the Provincial and Scottish road services between them consume come 60 million gallons of diesel oil annually. British Road Services get through about 25 million gallons of fuel a year. In total, the nationalized transport undertakings are customers of yours to the tune of about 220 million gallons of oil fuel a year now and much more in the near future. I wish I could say that our receipts from the conveyance of oil products by rail and road through our docks are commensurate with our oil fuel bill!

The railways only carried about 4½ million tons last year, the waterways about 2 million tons. These low figures are probably to some extent our fault. It is a specialized form of traffic and needs special treatment. The movement of oil by rail in complete trains, piped if necessary to facilitate discharge, can be a very efficient and economical form of movement. But each case needs separate examination by men who understand the special features of your business. The development of vehicles able to travel by road as well as rail opens up further prospects of interest for the future. We should also be very ready to see if we can help in any pipeline project you may have in mind.

I should like to end by saying something about your industry which you will not, I hope, resent. The petroleum industry in the world of today wields immense power. It does so not only within the nation but its power, to a large extent, transcends national boundaries. I have during the years of which I have been talking made the acquaintance of many leading men in the industry, especially in this country, but also to some extent in North America. The impression which I have formed is that we are extremely fortunate that the direction of this powerful industry is in the hands of such men. They are businessmen and shrewd businessmen, but luckily for us, I speak of those I know personally, they are all men with a statesmanlike outlook, men with a very high sense of the responsibility which power entails. And, therefore, very sincerely, I regard it as a high honour and a great pleasure to propose the toast of "The Institute of Petroleum".

The President Replies

Replying to the toast, Julian M. Leonard, said:

First of all, may I thank you, Sir Brian, for proposing the toast of the Institute and for the very kind things which you have said about us. You have been most generous in your remarks and I would like to think we deserve the praise you have given us. Maybe we do—or at least some of it.

I think it right to say that the Institute, founded some forty-seven years ago, is conscious of the part it has played in the British oil industry particularly, and is not unmindful of the status which it has achieved in very nearly half a century of progress.

I do not propose to take up your time this evening with heaps of figures and statistics of what the oil industry in general, and the Institute of Petroleum in particular, is doing, for you will be wanting to get among your friends as

early in the evening as you can. But the Annual Dinner of the Institute is a great occasion in our year and it behoves us to tell our friends something about ourselves.

The Institute, primarily a British Society serving the needs of the oil industry in Britain, has none-the-less acquired an international influence. It is thriving and has nearly 4200 corporate members and some 240 member companies. There are nine branches in Britain, and branches also in Bahrain, Kuwait, and Trinidad. Council has at present established nine technical and other committees and these in turn have given rise to groups, sub-committees and panels numbering in all some 96.

The various activities with which these are concerned are far too numerous to detail, covering, as they do, pretty well every aspect of petroleum and its products. I feel I should mention, however, that, in addition to engineering specifications and codes, standardization has always been one of the Institute's most important functions and in this work, particularly in conjunction with our American friends, we have done a very great deal in the field of international co-operation.

The Institute provides a forum for the discussion and study of all the many aspects of the finding, winning, refining, storage, and distribution of petroleum and its products. Its publications provide the means of disseminating knowledge in all the branches of our industry. The technical papers presented at our meetings, both at headquarters and in the branches, cover a range of subjects which are of the widest appeal in the expanding needs of our industry. These technical aspects are constantly growing in complexity and the Institute has always—and I think successfully—met this challenge to keep abreast of the frontiers of knowledge.

Turning for a moment to the petroleum industry itself, world production of crude oil in 1960 rose by 7½ per cent over that of 1959 and exceeded for the first time ever 1000 million tons; in fact it was 1052 million tons. The last ten years have seen a doubling in the world production of oil, which was 523 million tons in 1950. However, expansion of oil production in 1961 is not expected to be quite as great as in 1960 owing to the slowing down of world trade generally, but it is an interesting fact that three-quarters of the 1960 increase took place in the free world outside the U.S.A., and of this increase the Middle East contributed two-thirds.

Though there is a buoyant demand for petroleum products in the United Kingdom, where the increase is 17 per cent above the previous year—the highest increase in Europe—competition is intensely keen and profit margins have steadily diminished. But an increased demand for power in the United Kingdom is not confined to the oil industry alone, for coal consumption too has risen and this is a good thing for our economy. There is nowadays, I think, a better realization of the relative usefulness and uses of coal and oil.

Petroleum has lately been providing the raw materials for chemical synthesis on an ever increasing scale. This incursion into the realm of chemicals is an outstanding feature of recent times and is one of which we will hear much in the years ahead. Already, in the U.S.A. in particular, we have seen the supplanting of aromatic hydrocarbons derived from coal by petroleum-based products and it is no secret that the latter are often superior in quality to the older and traditional supplies.

It is estimated that the British petroleum chemicals industry is now three times the size it was eight years ago and has almost doubled itself since 1958, just two years ago. In 1958 it is said that petroleum-based chemicals represented in value about two-fifths of the total products of the British chemical industry and this proportion is steadily growing and is believed currently to be of the order of 50 per cent. There is little doubt that this expansion will continue vigorously for many years ahead.

One of the social revolutions which are taking place in our times is the spread of some form or other of central heating. In this oil is playing a prominent part through the development of equipment which is convenient and simple to manage. For many years—in fact since about the time of the coal strike in 1919—oil-fired central heating was regarded as practicable only in large installations and it was then thought to be very expensive. Now, taking our cue from the U.S.A., where even small domestic installations have become well-nigh universal, the oil-fired central heating system is spreading into very many of the homes in this country.

I would remind you that the Institute of Petroleum bears the responsibility for having originated the first World Petroleum Congress which was held in London in 1933 and the Permanent Council of the World Petroleum Congress has been based here ever since. Subsequent Congresses have been held at roughly four-year intervals in Paris, the Hague, Rome, and New York.

You will no doubt know that the Sixth World Petroleum Congress is to be held in West Germany (in Frankfurt) in June 1963 and great efforts are being made to ensure that it will be the most successful World Petroleum Congress ever held, particularly from a technical point of view. In conjunction with this, there is to be held a large exhibition of oil equipment and techniques in the grounds of the Exhibition Centre during the period of the Congress. This display should

The President and The Hon. M. R. Bridgeman, The Rt Hon. Lord Geddes, H. W. Rocke, H. E. Snow, and E. G. C. Mardall

prove an important adjunct to the technical papers and lectures and it is hoped very much that Great Britain will be as well represented at this exhibition as she will be at the Congress.

I repeat that I think it is very important that we should have really good British representation and support at this Congress in Frankfurt, not only at the technical sessions but also at the exhibition, and I appeal most earnestly to the British manufacturers of petroleum equipment to go there in strength. We were not as well represented at the last Congress in New York as we might have been and if we do not make a real effort this time the Germans, who are very keen, may well have it all their own way. I do hope that the Council of the British Manufacturers of Petroleum Equipment will bear this very much in mind.

I want to refer to a domestic matter of both practical and sentimental importance to us in the Institute—namely the impending retirement of our editor, George Sell. He has looked after the Institute's publications in quite an exemplary fashion for some thirty-five years and in so doing he has become something of a legend in the British oil industry in that time. Starting in Mr Eastlake's office in 1910, George Sell has been in petroleum harness since even before the Institute began. Mr Eastlake, you will remember, was the co-founder and for many years honorary secretary of the then Institution of Petroleum Technologists and later of the Institute.

A view of the top table

George Sell's service with the Institute of Petroleum was broken only by two world wars and by a short period on the staff of the *Petroleum Times*. For his outstanding services to the Institute he is to receive the Eastlake Medal. He is with us tonight and I am sure that all members of the Institute will wish him very many years of happiness and good health in which to enjoy his retirement.

I want also to express on behalf of all members of the Institute our warmest thanks and appreciation to the general secretary, Mr Hough, and to all of the staff at headquarters for their untiring devotion to the affairs of the Institute throughout the past year. I include also in this sincere appreciation the honorary officers of the branches and all those who have given invaluable honorary service to the Institute. For myself, I have had the fullest support and help whenever I have needed it and, particularly to Mr Hough and to Mr Sell, I would say on your behalf, thank you very much indeed.

I now come to a very pleasant part of my duties and that is to give a welcome to our guests. We are here tonight to meet old friends and to make new ones and, I hope, to enjoy an evening in pleasant company. I welcome each guest individually: not only those who are the official guests of the Institute but also those who are the private guests of individual members and I would say to all of you that we are delighted to have you with us.

It is invidious to mention names and, indeed, to introduce to you individually the Institute's official guests alone would be too great a task.

We welcome General Sir Brian Robertson, chairman of the British Transport Commission, who has so eloquently and so graciously given the toast to the Institute.

We have also with us tonight distinguished representatives of the Services, of our *Alma Mater* the Ministry of Power and of other Government Departments, of the law, of the learned societies, of kindred associations, and of trade organizations.

In particular, I feel I should remind you that we have with us two old friends who have come a long way across the Channel to be with us this evening, namely: M. Navarre, director of the Institut Français du Pétrole and M. Vautrin, President of the Association Française du Techniciens du Pétrole. We also have Mr Jacobs, the Petroleum Attaché at the Embassy of the U.S.A. in London, and we welcome also, and as ever, our friends from the press whom we are so glad to see.

And, last on my list and by no means the least, I welcome the chairmen and managing directors of our great oil companies whose support and encouragement we value so much. Without all they do for us, particularly behind the scenes, we would be much the poorer. We are very glad to have all our guests with us tonight and, in giving you the toast of our guests, I bid all of them the warmest of welcomes and I couple this toast with the name of Mr Paul Chambers, chairman of Imperial Chemical Industries.

The Guests Reply

S. P. Chambers, replying on behalf of the guests, said he felt greatly honoured at being asked to speak for so many distinguished guests.

After speaking in light-hearted vein, he said they were all grateful to the Institute for such good company, good food, and good wine.

SUGGESTION FOR AN INSTITUTE OF CORROSION

Formation of an Institute of Corrosion and the classification of workers in the corrosion field into research workers, specialists, and general practitioners, on the lines of the medical profession, were two suggestions made by C. L. Wilson at the 2nd Annual Dinner of the British Association of Corrosion Engineers held at the Waldorf Hotel recently.

He suggested that the Corrosion Science Group led by Dr T. P. Hoar, the corrosion group of the Society of Chemical Industry, and the BACE should get together and form a body to correlate work and disseminate information.

Saharan Expansion Boosts French Crude Output for 1961

The latest statistics issued by the Comité Professionnel du Pétrole in Paris show that French crude oil production rose by 21·7 per cent in 1960 to 11,406,800 metric tons. The increase was due largely to the continued expansion in output from the Sahara which reached 8,542,200 tons compared with 1,228,700 tons the year before.

Smaller increases were recorded in Metropolitan France where production was 1,997,900 tons in 1960 and 1,610,100 tons in 1959; Algeria, 6100 tons against 3700 tons the previous year; and the Gabon-Congo where output of 860,600 tons was 107,300 tons higher.

Production of natural gas in Metropolitan France totalled 4548 million cu m in 1960, a rise of 1934 million over the preceding year. Sales of refined gas doubled during 1960 to 2615.4 million cu m, of which 1960 million cu m was consumed by industry—827·5 million cu m by central electricity organizations. Its use as town gas increased spectacularly from the 1959 figure of 208·5 million cu m to 585·8 million cu m.

Imports also rose slightly in 1960 from 31,269,000 tons in 1959 to 33,554,000 tons, comprising 31,022,000 tons of crude oil and 2,532,000 tons of finished products.

TABLE I

OUTPUT OF FINISHED PRODUCTS

(Thousand metric tons)

Refinery	*Company*	1949	1959	1960
La Mede ...	Cie Fcse de Raffinage	1,477	4,622	5,104
Gonfreville ...		2,041	3,065	3,352
Donges	Antar Pétroles de l'Atlantique	621	2,101	2,222
Merkwiller ...		41	101	108
Merkwiller ...	Pechelbronn	—	55	50
Lavera	Soc Fcse des Pétroles BP	1,350	2,232	2,510
Dunkirk ...		—	1,860	2,198
Berre	Shell-Berre	922	3,512	3,430
Pauillac ...		310	360	267
Petit-Couronne		1,467	2,603	2,905
Frontignan ...	Mobil Oil	448	1,168	1,074
Gravenchon ...		482	856	837
Port Jerome ...	Esso	1,664	3,331	3,207
Bordeaux ...		—	693	1,341
Ambes	Union Industrie de Pétrole	—	1,066	1,046
	Total	10,823	27,625	29,651

Refinery capacity was slightly higher also at 40,240,000 tons. Refinery throughput of crude increased by a little over 2 million tons to reach 32,890,000 tons. Since 1949 output of finished products from French refineries has almost tripled and in 1960 reached 29,651,000 tons as can be seen in Table I.

Consumption in Metropolitan France rose by a little more than 2 million tons in 1960 to 22,866,800 tons, almost three times higher than in 1949. Details are given in Table II.

Exports, including bunkers for foreign ships, showed a small increase from 6,512,000 tons in 1959 to 6,924,000 tons.

TABLE II

CONSUMPTION OF FINISHED PRODUCTS

(Thousand metric tons)

Product	1949	1959	1960
	Metropolitan France		
Aviation gasoline ...	71·9	198·6	158·3
Motor Gasoline:			
Standard grades ...	1,913·0	3,444·0	3,526·7
Premier grades ...	—	1,601·4	1,892·0
	1,913·0	5,045·4	5,418·7
Industrial spirits ...	60·7	114·7	117·8
Kerosine and jet fuel	129·7	225·2	405·6
Gas oil	751·7	1,564·2	1,697·8
Fuel oil:			
Domestique ...	542·0	3,498·4	4,261·0
Light	457·3	2,209·6	2,491·8
Heavy	3,110·4	5,289·7	5,651·1
Lubricants	246·5	493·5	525·0
Liquefied petroleum gas	77·9	808·8	892·7
Bitumen	394·7	1,043·1	1,155·0
Other products ...	53·0	82·2	92·0
Total Metropolitan France	7,808·8	20,573·4	22,866·8
	French Colonies		
	633·9	1,377·2	1,348·2

★ ★ ★

Exploratory Activity in Persia

Recent exploratory drilling activities in Persia outside the Consortium concession area include the end of testing on Alborz No 8 and the commencement of preparations for the drilling of well No 9. Two wells are being drilled at Sarajeh, and at Gorgan well No 5 has been abandoned.

Both of the Iran Pan American offshore wells have reached final depth and are undergoing test. In the SIRIP concession the second offshore well—which is being drilled from the same fixed platform as the closed-in No 1—has been diverted and is now drilling ahead in the new hole. For the second winter drilling at the Sequta well, which is situated at the top of an 8200 ft mountain in the Zagros agreement area, has been temporarily suspended due to extremely low temperatures and bad weather.

The table below shows footage drilled in Persia in 1960 and 1959.

	1960	1959
NIOC	24,554	40,858
Iranian Oil Exploration and Producing Co. (Consortium)	106,494	102,984
SIRIP	18,171	6,925
IPAC	16,661	8,989
	165,880	159,756

GEORGE SELL

On 1 August 1910 a young man named George Sell entered the employment of Arthur W. Eastlake, Consulting Petroleum Engineer. Although the fact was probably not fully appreciated at the time, the petroleum industry, and in particular petroleum journalism, had gained a notable recruit. Except for service abroad from 1914–1919 Mr Sell remained with Mr Eastlake and his partner, William Sutton, till 1930. These were not the days of over-specialization and his work combined that of a private secretary, a technical assistant, a draughtsman, and anything else that might be required. In this period he laid the foundations of a very wide knowledge of many facets of the petroleum industry and of many of the important figures in it.

Mr Eastlake was one of the 29 Founder Members of the Institute when it was incorporated in 1914, following an agreement in November 1913, so that in consequence Mr Sell had an unofficial association with the Institute even before it formally existed, and this increased when Mr Eastlake became the honorary secretary of the newly-formed Institution of Petroleum Technologists under the presidency of Sir Boverton Redwood. Having become a Student Member in 1920 and an Associate Member in 1922, Mr Sell became officially one of the staff in 1923 when he accepted part-time employment as associate editor of the Institutions' publications, Dr A. E. Dunstan being the honorary editor. To this was added, in 1925, the further appointment of secretary to the Standardization Committee. Soon after he became a full-time member of the staff in 1930, the duties of librarian were also added. From 1937 to 1939 Mr Sell was associate editor of the *Petroleum Times* and again from 1945 to February 1946, the period from 1939 to 1945 being spent with the Petroleum Department of the Board of Trade (later the Ministry of Fuel and Power). From 1945, however, he also acted as part-time editor of the Institute's Journal until in March of 1946 he rejoined the Institute as publications secretary and editor. Even when not actually a full-time member of the Institute's staff, Mr Sell has always been in close touch during 48 years of the 50 in which he has been associated with petroleum matters.

This bare outline of his career gives no real picture of George Sell's work for the Institute. On the publications side, successive committees and sub-committees and their chairmen have come to rely on him for getting the most difficult jobs done and particularly in regard to that essential of publication, the maintenance of the time-schedule. His technical knowledge of printing, typography, binding, block-making, costing, and all the other details which, together with accuracy and good writing go into the successful production of books and periodicals, have been invaluable. These abilities, in addition to a tremendous amount of hard work, have contributed in no small measure to the building up and maintenance of the standard of the Institute's *Journal* and Abstracts and to that of the various book publications which have been produced, particularly since 1946. Even more marked has been his contribution to the popular *IP Review* since it commenced in a small way, hampered by paper restrictions and other difficulties, in 1946. Much of the material in the *Review* has been collected or written by himself in addition to the more normal editorial duties.

Acting as secretary to the Publications Committee and its five sub-committees, preparing reports, summaries, and surveys for them and implementing their decisions has been in itself almost a full-time job. The successful organization of technical meetings is not always an easy matter; there are often last minute unexpected difficulties ranging from late delivery of papers to projector failure, and few regular attendants of such meetings can fail to have been impressed by the efficiency and calmness with which George has always dealt with such emergencies when they have arisen. Few also will forget his photographic abilities when on social occasions his camera recorded a cross-section of people and events.

As many will remember him

His help and services to Standardization Committee, to the Branches, to the members seeking information on a wide variety of subjects, could be catalogued extensively. They have been greatly appreciated and will not be forgotten. It is not surprising that George Sell has a host of friends in this and many other countries.

Mr Sell became a full Member of the Institute in 1928, and a Fellow when the Constitution was changed in 1939. It is entirely appropriate that he will be the recipient shortly of the Eastlake Medal, awarded for long and meritorious service to the Institute, and founded in memory of Arthur W. Eastlake, a founder and for many years honorary secretary of the Institute, and the man who introduced George Sell to the petroleum industry.

Mr Sell retired from the post of editor on 31 March 1961, having given most of his working life to the service of the Institute. He takes with him the good wishes of a host of friends, many of whom have been very closely associated with him in his work and all of them, like the writer, who has known him for over 30 years and enjoyed a very close and happy collaboration with him for more than half of this time, would wish to pay tribute to his unfailing cheerfulness and help as well as to his outstanding work for the Institute. It is good to know that, in the activities Mr Sell has planned for his "retirement", his connexions with the Institute's work will continue.

E.B.E.

Mr Sell is succeeded as editor by M. J. Wells, who has been his assistant for the past 2½ years. Mr Wells has also had experience with the Petroleum Information Bureau. We would like to express our best wishes to him in his new appointment.

* * *

World Crude Oil Reserves

Estimated proven crude oil reserves in the world at the end of 1960 totalled 300,987 million brl, according to the latest country-by-country estimate of the *Oil and Gas Journal*. This shows an increase of 10,817 million brl, or 4 per cent, over the estimate of the end of the preceding year.

The figures in this total for the U.S.A. and for Canada are also those of the *Oil and Gas Journal*, as the official API and CPA estimates for 1960 are not yet available. United States reserves were said to be 33,535 million brl, whilst those of Canada were 5000 million brl. These indicated rises of 6 per cent and 43 per cent respectively over the official statistics for 1959.

Middle East reserves have risen by 1724 million brl to a level of 183,160 million brl—60 per cent of total world proven reserves of crude oil. This is less than a quarter of the rise estimated at the end of 1959. Reserves for Kuwait, Saudi Arabia, and Iran—the three countries of the area estimated to have larger proved reserves than the U.S.A.—are indicated as being the same as on the previous estimate. Among the smaller Middle Eastern states Syria's total has risen from 1 million to 50 million brl and that of Southern Arabia from 100 million to 250 million brl (including offshore).

Reserves in the African continent (including Egypt) rose by 826 million brl to over 8099 million brl—a climb of 11 per cent which is a considerable slackening off in increase compared with previous years. The countries of the Communist bloc are estimated to have increased their proven crude reserves by 3365 million brl—a rise of nearly 50 per cent greater than that achieved a year before—to reach a total of 33,502 million brl. Of this figure Russia is thought to have contributed 31,500 million brl.

As can be seen from these estimates the general slackening off in world-wide drilling activity has resulted in a slight slowing down in the annual increase in crude oil reserves. Such published statistics are of considerable interest, for although they are merely the *Oil and Gas Journal*'s own estimate they are virtually the only source of published information available anywhere.

Further details are given in the table. All figures are for crude oil only, and do not include natural gas liquids.

PROVEN CRUDE OIL RESERVES

Thousand barrels

Country	*Reserves at end of* 1960
Argentina	2,200,000
Bolivia	95,000
Brazil	300,000
Colombia	750,000
Chile	110,000
Cuba	1,800
Ecuador	30,000
Mexico	2,250,000
Peru	375,000
Trinidad	450,000
Venezuela	18,500,000
U.S.A.*	33,535,000
Canada	5,000,000
WEST'N HEMISPHERE	63,596,800
Austria	275,000
France	225,000
West Germany	500,000
Italy	320,000
Netherlands	250,000
U.K.	5,000
Yugoslavia	147,000
WESTERN EUROPE	1,722,000
Bahrain	250,000
Iran	35,000,000
Iraq	27,000,000
Israel	35,000
Kuwait	62,000,000
Kuwait–S. Arabia Neutral Zone	6,000,000
Qatar	2,500,000
Saudi Arabia	50,000,000
Southern Arabia	250,000
Syria	50,000
Turkey	75,000
MIDDLE EAST	183,160,000
Australia	1,000
British Borneo	500,000
Burma	45,000
Formosa	500
India	750,000
Indonesia	9,500,000
Japan	60,000
New Guinea	25,000
Pakistan	25,000
FAR EAST	10,906,500
Algeria (incl. Sahara)	5,200,000
Angola	30,000
Egypt	550,000
Gabon	150,000
Libya	2,000,000
Morocco	9,500
Middle Congo	10,000
Nigeria	150,000
AFRICA	8,099,500
U.S.S.R.	31,500,000
Roumania	1,000,000
Hungary	200,000
Albania	15,000
China	750,000
Czechoslovakia	12,000
Poland	25,000
COMMUNIST BLOC	33,502,000
TOTAL WORLD	300,986,800

*Includes offshore.

Around the Branches

ABADAN, BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD, YORKSHIRE

Essex Branch

The Branch held its Annual General Meeting at The Bull Hotel, Pitsea on 8 January 1961.

After disposing of the formal business, the Branch followed its usual practice of having a not too serious topic for the subject of its talk. Squadron-Leader C. Maughan of the R.A.F. gave a most entertaining and interesting account of the London to Paris air race. His enthusiasm and witty presentation made it easy for the audience to share the excitement which the speaker must have experienced at being the winner of the race.

Following the talk Squadron-Leader Maughan presented a most entertaining film. The general opinion of the audience was that this was one of the most enjoyable evenings they had had.

Members of the Essex Branch will recognize the following in this group, photographed at their AGM by R. Grant: (from left to right) *W. Macqueen and G. Wiseman* (both committee members); *D. Rawlinson* (honorary secretary of the Branch); *L. T. Hogg* (honorary treasurer); *D. H. Tullis* (past-chairman); *D. Varcoe-Cocks* (vice-chairman); *Squadron-Leader C. Maughan of the R.A.F., who gave a talk to the meeting; E. G. Hannah* (chairman); *and A. F. Pyrah* (committee member)

Stanlow Branch

With C. N. Thompson in the chair, Professor Revans of the Industrial Administration Department of the Manchester College of Science and Technology gave a talk on the "Monte Carlo Method" to members of the Branch and visitors on 18 January.

Professor Revans related the method to the arrival, berthing, and discharge of tankers. In analysing the problems, he said that tankers were divided into three classes, and the interval between arrivals and hours of jetty occupation were noted. Darkness and the state of the tide were also taken into account.

From an analysis of all these variables the usefulness of the Monte Carlo Method was clearly demonstrated. It was shown how it could be used to forecast the probable necessity of providing more jetty space, and to give a forward picture of the whole operation.

South Wales Branch

R. P. Hagerty, Ph.D., A.R.I.C., of the Ministry of Aviation Rocket Propulsion Establishment at Westcott spoke to the Branch on 19 January about "Fuels for Rocket Propulsion".

Dr Hagerty covered all aspects of rocket fuels, dealing with their basic requirements, their specialized uses, and their possible future. The talk was illustrated with slides and a large number of questions were answered in a most engaging fashion by the speaker.

Trinidad Branch

At the 33rd Annual General Meeting of the Trinidad Branch held on 20 January, L. Hawkins, D. P. J. Holbrook, and E. G. Marsden were elected to the 1961 Committee.

A number of films were shown during the evening including a news-reel; "Speed the Plough"; and "The Inquisitive Giant" which dealt with the background and construction of the Jodrell Bank radio telescope.

At a subsequent Committee meeting Dr A. L. Down was re-elected chairman of the Branch and W. G. Poole was re-elected hon. secretary treasurer.

Northern Branch

"The Petroleum Industry's Role in the World Car Market Development" was the subject of the lecture delivered to the Branch on 14 February. The author, Dr K. E. W. Ridler of The British Petroleum Company, was not able to attend in person but presented the talk by the novel method of making it the commentary of an illustrative film. He began by showing how the growth in the world car market had resulted in the motor industry's expansion of productive capacity, in changes to suit particular operating conditions, and a competitive selling price. The requirements which the car manufacturers had to satisfy had called for a parallel development of automotive products originating from petroleum and, in particular, fuels and lubricants.

The rest of the lecture was devoted to the research and development which was being done to ensure that these products met the varying requirements. The relationship between the compression ratio of an engine and combustion quality of the fuel received careful attention. The tests varied from the laboratory test bed, through the vehicle dynamometer, to full scale road tests in many countries. Lubricating oils had to withstand exceptionally severe conditions in normal use in many countries, and road tests had to be devised to

ensure that the test conditions were of greater severity. In general, the lubricants had to meet the car makers' specifications, and give the customer trouble-free operation of his vehicle with minimum wear and long life at a reasonable cost. The petroleum industry's high standards and quality had to be maintained to ensure continuation of business.

The petroleum industry and the motor industry had a common interest in this field, which had resulted in close co-operation between the two to solve the problems which were constantly arising.

During the ensuing discussion Messrs Lonsdale, Reynard, and Newman of The British Petroleum Company replied to a wide variety of questions from the audience.

The lecture was followed by the Annual General Meeting of the Northern Branch with T. G. Provest in the chair. In his report he referred to the healthy state of the affairs of the Branch and thanked the various officers for their services during the past year. The accounts, presented by the Hon. Treasurer, Dr P. J. King, were approved, and T. D. Bowker, B. E. Hurley, H. Kaye, A. Swain, G. Walker, and E. R. Wilson were elected to the Branch Committee.

Scottish Branch

At a meeting of the Branch held in the North British Hotel, Edinburgh, on 16 February, Dr W. B. Peutherer, presided and introduced G. H. Thornley, M.Sc. who spoke on "Lubricants—Advances in the Last Ten Years".

He said the principal activity in the last decade had been in the field of additives and in the application of synthetic lubricants to special requirements. For four-stroke engines the tendency had been towards lower viscosity oils and higher detergency levels with interest also directed to viscosity index improvers and, in consequence, multigrade oils. Two-stroke engine lubrication had been advanced by oils which control exhaust port blocking, bearing corrosion, spark plug fouling, and piston lacquering.

Mr Thornley then discussed the progress made in oils specially designed for high speed oil engines and their detergency requirements. He said that for low speed diesel engines additives had been developed to deal with high sulphur residual fuels.

Due to the wide operational temperature range required of lubricants for gas turbine engines, as well as the need for high load carrying capacity, synthetic compounds and additives designed to meet these demands had been developed. With steam turbines the requirement was for very long use of oils.

The increasing use of hypoid gears with their high rubbing speed and loading conditions, and the progress made in additives for EP oils were discussed, and finally Mr Thornley dealt with problems of nuclear power plants, involving radiation and hot carbon dioxide, which degrade conventional greases. He told how lubricants designed to combat these conditions, and be compatible with alloys used in the reactors, had been developed.

The Cadman Memorial Medal and Lecture

The Council of the Institute of Petroleum has awarded the Sixth Cadman Memorial Medal to Sir Stephen Gibson, C.B.E. The medal will be presented to Sir Stephen when he delivers the Cadman Memorial Lecture on 31 October 1961 in the hall of the Royal Institution, London.

Sir Stephen Gibson

Sir Stephen, who was President of the Institute during the period 1952–4, has been a member of the Institute since 1928 and became a Member of Council in 1949. He is also Chairman of the Permanent Council of the World Petroleum Congress.

He first entered the petroleum industry in 1922 when he joined the Anglo-Persian Oil Company (now The British Petroleum Company) as a production engineer. In 1928 he was appointed production superintendent and after being successively production manager, assistant fields manager (production), and assistant general manager (production) he was appointed general fields manager in 1945. In 1948 Sir Stephen returned to the United Kingdom and took charge of the Company's Production Research Station at Kirklington Hall, Nottinghamshire.

At the beginning of 1950 he was appointed managing director of the Iraq Petroleum Company and Associated Companies, a position which he held for 7½ years until his retirement in 1957.

Sir Stephen was appointed a C.B.E. in 1947 and received his knighthood in 1956.

The production of oil from limestone reservoirs has been a lifelong study by him and the title of his lecture when he received the Institute's Redwood Medal in 1947 was "The Production of Oil from the Fields of South-West Persia".

THE CADMAN MEDAL

The Cadman Memorial Fund, which was contributed by The British Petroleum Company Ltd, to commemorate the work of the late Lord Cadman, provides for a Cadman Memorial Lecture to be given at least once every three years and for a medal to be presented to the lecturer. The Institute of Petroleum is trustee of the Fund.

The first lecture (1946) was given by Lord Strathalmond, and the succeeding lectures were:

"Progress in Petroleum Research", by R. Price Russell.
"Competitive and Co-operative Research in the American Petroleum Industry", by Dr R. E. Wilson.
"Winning Petroleum", by C. A. P. Southwell, C.B.E., M.C.
"Oil and Education", by the Rt Hon. Lord Godber of Mayfield.

NEW IP GLOSSARY OF PETROLEUM TERMS

The Third Edition of the Institute's *Glossary of Petroleum Terms* has now been published, price 5*s*. Revised and greatly enlarged in comparison with previous editions, it contains definitions of some 500 petroleum terms, arranged in alphabetical order. Details of terms used in U.K. petroleum legislation and abbreviations for the titles of many official bodies are provided in two appendices.

Lubrication of Gears in Service[*]

By G. C. MUDD[†]

There are many different gear applications and each application requires a careful choice of type of gear, materials, and lubricant. It is intended in this paper to consider the factors governing the choice of a lubricant for three important types of gear, namely parallel shaft gears, hypoid gears, and worm gears, and to show the steps which are taken by the gear manufacturer to ensure effective lubrication and which will afford maximum prevention against lubrication failure.

Functions of a Lubricant

Most metals in a normal atmosphere are coated with an oxide film, which is often quite invisible. If this film is removed and a friction test made in a vacuum then the value of the coefficient of friction can be as much as 20 times that of the same metals with the film present. This is due to the interpenetration of the molecules which cannot occur when the surfaces are oxidized. Unfortunately however, this film is easily removed and when sliding is introduced between the surfaces, pure metal to metal contact is made and damage in the form of welding of the metals results. In gear tooth operation therefore, where there is a considerable degree of sliding, it has been necessary to provide a protecting film and lubricating oil has been found the most convenient means of keeping the metals apart.

The relative sliding between the gear teeth gives rise to frictional heat in the zone of contact and a secondary, but important, function of an oil supply is to transfer this heat away from the gear to the housing walls where it is lost by radiation and convection. When the loads imposed are high, or when the sliding conditions are severe, the film can no longer support the load and breakdown occurs with resulting failure.

Scuffing

The contact conditions between spur or helical gear teeth are such that near the roots of a tooth relative sliding is combined with the rolling action. This changes, as the point of contact moves down the flank, through pure rolling at the pitch line to combined sliding and rolling conditions again at the tip. Broadly speaking the greater the numerical value of the sliding component the worse are the lubrication conditions. Therefore, when excessive loads are imposed, the lubricating film tends to break down initially at the roots and tips of the teeth. Once this has occurred metal is removed and the damage spreads rapidly.

The welding at the points of metal-to-metal contact results in material being dragged in the direction of sliding, and this type of failure is given the broad name of scuffing. The appearance can vary depending on the severity of the weld and many names have been given to these apparently different failures (*e.g.* galling, scoring, or ridging), but the difference is one of degree rather than kind.

An advanced type of scuffing occurs where the gear has continued to run until a large proportion of the tooth has been removed. This is usually a result of oil starvation rather than the use of an oil with too low a film strength. An interesting example of this type of failure occurred recently. A 17-in crs. increasing gear, 1450–8300 rev/min, failed during its initial run and on inspection was seen to have scuffed. The severity of the damage suggested that the teeth had been running with little lubrication, but to discount this view the plain bearings, supplied from the same source, had obviously been receiving an adequate supply of oil. The oil became suspect, but tests carried out on a sample of the lubricant taken from the unit proved its quality to be satisfactory. Since the unit was coupled to a turbo-compressor the possibility of shock loading was remote. Also, data supplied by clients showed that neither full speed nor load had been transmitted.

The gear was reconditioned, and on the re-starting of the plant it was noticed that an orifice plate had been interposed between the lubricating pump and the unit to obtain sufficiently high pressure supply to some auxiliary equipment fed along small-bore tubing on the pump side of the plate. Calculation had shown that a sufficient quantity of oil would reach the unit, but unfortunately a pressure gauge had not been fitted on the unit side. When one was installed the reason for failure became apparent. On starting the pressure was 10 psi as predicted, but as speed increased the pressure dropped by 1 psi per 100 rev/min; the bearings were sucking in oil at the greater speeds. If the unit had been allowed to attain a high speed a stage would be reached where the bearings would be drawing all the available oil and little or none would pass through to the gear teeth. When the hole in the orifice plate was enlarged and the pump delivery pressure increased the pressure steadied off at 13 psi at 6500 rev/min, and the gear ran satisfactorily.

Wear

If a gear continues to run while scuffing conditions exist then metal is continually being removed from the flanks. There seems, however, to be a different kind of failure usually called "abrasive wear" which results in a smooth matt surface entirely different from a scuffed appearance. It usually occurs when one of the materials is comparatively soft. The failure is due to a breakdown in the oil film, probably only a partial failure, and the different appearance may be due to the low shear strength of the material which would allow metal to be removed close to the point of weld. In harder steels work hardening at the point of weld may be sufficient to result in material being torn away at a much greater depth, causing the typical scored appearance.

In addition, wear would occur if abrasive dust had been allowed to mix with the lubricant. In this case it would tend to be picked up by the softer material and the harder gear would be lapped away.

The usual palliative for abrasive wear occurring with clean lubricant is to use a more viscous oil in which the thicker film and the lower coefficient of friction will at least reduce the rate of wear and may arrest it completely.

[*] Presented to the IP Northern Branch on 15 March 1960.

[†] Development engineer, David Brown Industries Ltd.

Pitting

Pitting is a surface fatigue phenomenon, and therefore is not usually considered as being appreciably affected by the lubricant. However, because of the sliding motion there is a tangential force at the mating surfaces, the magnitude of which depends on the coefficient of friction. It has been proved that the resultant force and the position of the point of maximum shear stress is affected, and it can be argued that the greater the frictional force the greater the tendency for surface fatigue to occur.

Also, if a gear has pitted then lubrication failure may occur when a sufficient area of the tooth surface has been lost. The surface loading is increased, continuity of motion may be lost, and scuffing may eventually result.

Choice of Lubricant

For spur or helical gears, experience has shown that straight mineral oils have adequate film strength to prevent scuffing for all normal loading conditions. It is a question therefore of choosing the most suitable viscosity of lubricant for a specified duty. An empirical method used with success has been to use the value $\frac{H\ Sc}{V}$ as a guide to the viscosity, (H = DPH Sc = load/inch Vs = P.L.V.) where:

H = Diamond pyramid hardness of wheel.

Sc = $\frac{\text{Load/inch of line of contact}}{\text{Relative radius of curvature (in).}}$

Vs = Pitch line velocity (ft/min).

The oil grade is then given by Table I.

TABLE I

SPUR HELICAL AND BEVEL GEARS

$\frac{H\ Sc}{V}$	*Below* 12·5	12·5 *to* 30	30 *to* 150	150 *to* 350	350 *to* 900	900 *to* 2500	2500 *to* 7000	*Above* 7000
Approximate viscosity cS at 60 C.	20	25	30	45	70	100	150	250

The range has been divided into eight grades 1–8, and the viscosity of the oil grade chosen by this method will then increase directly with the hardness and surface loading, and inversely with the pitch line speed. The latter ensures that the churning losses are minimized at high speed and that the oil is thin enough to reach all parts of the teeth as they go through the oil bath.

Experience has justified the use of this method, but modifications have been proved necessary when special conditions occur. For instance, oil of the next higher viscosity should be chosen:

(1) When ambient temperatures are above 27 C (80 F);
(2) When the same materials are used for mating gears, or when nickel or nickel chrome steels are used, except case-hardened or nitrided steels (these materials seem to show a marked tendency to weld, possibly because of their mutual solubility);
(3) The gears are subject to shock loading (it is advisable to use extreme pressure oils in these cases).

Oil of the next lower viscosity should be chosen when:

(1) The ambient temperature is normally below 5 C (40 F);
(2) The gears are of high accuracy;
(3) The teeth have been phosphated or sulphur impregnated;
(4) When the gears are spray lubricated and $\frac{H\ Sc}{V}$ exceeds 150.

It should be noted that viscosity itself is not a guide to the effectiveness of an oil, but it is a convenient index for grading oils whose qualities have been proved.

Testing

To prove the quality of an oil it is necessary to subject it to a test procedure which will indicate its basic properties when operating under gear contact conditions. One test machine which is well known is the IAE machine which uses actual gears for this purpose. Another type is the disk machine which combines sliding with rolling and can therefore reproduce gear tooth action for one chosen position on the flank. The latter machine enables the close control of surface finish and test piece accuracy. Briefly, the disk machine comprises two disks which can be pressed together and rotated at selected peripheral speeds and slide roll ratios. Thus a measure of the performance, both of load carrying capacity and coefficient of friction of any oil, can be compared with that of standard reference mineral oil. Reference tests are carried out before and after running the test oils to ensure that the testing technique and the machine itself maintains the requisite standard of accuracy.

Effect of Viscosity

The higher the viscosity of a lubricant the greater the resistance to scuffing, e.g. with a Vs/Vr of ·833 the viscosity above 50 cS has little effect on scuffing load. $\frac{Vs}{Vr}$ = Slide/roll ratio.

Surface Finish

It must be remembered that the accuracy of the gear teeth has a great effect on the performance of the gears. If the actual contact of a gear differs from the theoretical then some part of the tooth is overstressed and so is the lubricant. In the same way the surface finish is also important. When newly-machined gears are run together the load is supported on the asperities which inevitably result from the machining process. The surface loading therefore is high at these points and if in addition the gears were subjected to overload torque there is a danger that scuffing may occur. With ductile carbon steels the asperities are quickly removed by plastic flow and wear and a highly-polished "run in" surface results. When hardened alloy steels are used then the surface stress is correspondingly higher and also the asperities resist the running-in process. Thus there is a greater danger that the oil film may break down. A. D. Newman, in his paper to the Institution of Mechanical Engineers in November 1959 on "Extreme Pressure Lubricants for Marine Gears", draws attention to this fact, and suggests that for marine gears, where trials are often carried out under overload conditions, an initial charge of EP oil should be used. The high spots would then be protected against scuffing until they had been removed by wear or deformation.

Friction

Some idea should now be given of the factors which affect frictional loss through the gear tooth surfaces. Fig 1 shows the variations of coefficient of friction with sliding velocity of oil having a viscosity of 30 cS at 60 C. The three curves show the effect of a varying slide/roll ratio, the coefficient of friction increasing as the slide/roll ratio increases. Using values from graphs such as these an estimate can be made of the coefficient of friction at points across the tooth flank for any rotating speed. Such an analysis indicates that the coefficient of friction increases as the speed decreases. The power loss however, which is the product of frictional loss and speed, increases as does the power transmitted so that the

tooth loss expressed as an efficiency is proportional to the coefficient of friction.

These results have been confirmed by controlled gear tests using a circulatory power system.

Disk tests also show that the coefficient of friction decreases to about 70 per cent of the values shown when another mineral oil is used having a viscosity of 100 cS at 60 C.

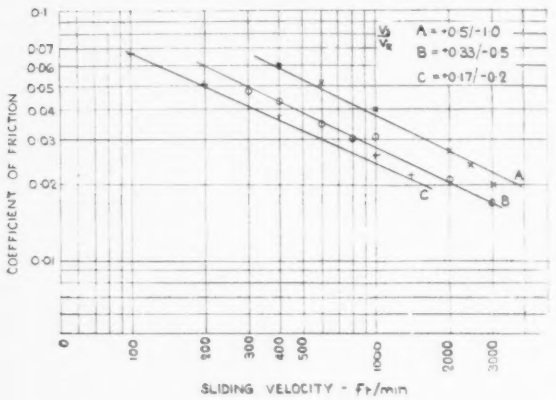


Fig 1

Other Properties

In addition to the mechanical properties discussed above, the lubricant must possess several other properties to successfully withstand the service conditions. As oil passes through the gear tooth surfaces it is subjected to high pressure and temperature and because of the motion of the gears violent agitation of the oil with air takes place. In these conditions oxidation and sludge formation are accelerated. By incorporating additives in the lubricant however, these undesirable features are discouraged or prevented. Also, in lubrication systems common to turbines and gears, oil may come into contact with water, and therefore the oil must have good demulsification properties so that the formation of emulsions is avoided. Other additives known as extreme pressure agents are incorporated into the oil for very severe conditions of loading and slide/roll ratio, and they operate by forming a chemically-bonded film of low shear strength on the metal surfaces. As with oil films they prevent true metal-to-metal contact and are effective for much higher surface loading values. The additives used have usually a phosphor chlorine or sulphur base.

Application of Lubricants

The method of applying the lubricant to enclosed spur or helical gears is either by dipping the teeth of one or more members into an oil bath; or spraying oil under pressure on to the teeth, the oil then being drained into a sump from which it can be re-circulated.

The first method is cheap and convenient, providing there is a sufficient case area to dissipate the frictional heating so that the temperature rise of the unit is not excessive. There is a limit however to the allowable peripheral speed of the gears; 2500 ft/min being a usual figure. Gears running at speeds in excess of this may be lubricated by an oil bath however, if the wheel is enclosed in a shroud. Sufficient oil to lubricate the teeth is allowed to enter at the base of the shroud but the churning losses are considerably reduced. Speeds of up to 4500 ft/min are allowable.

If the peripheral speeds are in excess of 2500/3000 ft/min without a shroud, channelling may occur, oil may not reach the tooth flanks in sufficient quantity, and lubrication breakdown will result. It then becomes necessary to spray the oil on to the gear teeth. Churning losses are considerably reduced by this method and increased efficiency is obtained.

The circulated oil may be passed through a cooler if required, to maintain a reasonable temperature in the unit. It should be remembered however that providing the oil affords sufficient protection to the teeth, excessive cooling increases the viscous losses in the bearings and in churning, and the efficiency of the unit suffers. A running temperature of about 140–160 F is considered reasonable.

In some applications a heater is incorporated in the sump to prevent the oil temperature becoming too low. Care is taken to ensure that the surface temperature of the heater does not reach a figure which would result in carbonization of the oil. As seen in the scuffed gear example, a pressure gauge must be fitted close to the actual spray.

The quantity of oil sprayed on to the gear teeth is such that frictional heat generated by the teeth gives a temperature rise of 30–50 F. Allowing a calculated quantity for plain bearings the discharge of the pump is then known. The sump or oil tank should then be made sufficiently large to contain at least 3 minutes supply. Quantity in gal/min = 0·006 hp + 3·0 (60 per cent to gears 40 per cent to bearings), is a useful empirical formula.

Hypoid Gears

In recent years the hypoid gear has come into favour for use in the rear axles of cars and buses. The gear is similar to the spiral bevel gear, but the pinion is offset from the wheel centre line. The offsetting of the pinion introduces a longitudinal sliding component at the line of contact and severe lubrication conditions exist which plain mineral oil cannot withstand. An extreme pressure oil is required which provides a film of low shear strength on the surfaces, effectively forming a protection against scuffing.

It is usual, in addition, to surface treat the gears (which are usually made of case hardened steel) by phosphating. In addition to providing a protective film, this treatment also gives a porous surface which "holds" the lubricant effectively, but its chief function appears to be one permitting the surfaces to run in gradually.

Worm Gears

In worm gears the contact conditions are also severe. Again sliding and rolling is present, together with sliding along the contact line. Since the latter tends to remove the oil film without bringing fresh oil into the mesh it may be considered to be entirely unfavourable. Consideration of the slide-roll conditions normal to a contact line on a wormwheel tooth show that a ratio greater than unity is obtained on the entering side, while on the leaving side the slide-roll ratio is less than unity. Disk tests have shown that the latter conditions give the better lubrication conditions and the lower coefficient of friction. Therefore it is reasonable to suppose that better lubrication exists on the leaving side of the tooth even when the longitudinal sliding component is present. This is confirmed in practice by observations of the temperature rise of a worm gear unit which is invariably lower when the contact marking favours the leaving side. This method of setting is usually referred to as providing an "entry gap." By this means load is then supported on the part of the tooth

most likely to resist lubrication breakdown failure and to improve efficiency.

When lubrication failure occurs the most usual manifestation is wear. An instance of this was the failure of some small units used for revolving an advertisement, where the wheel teeth were worn completely away. Numerous tests were made to reproduce the service failure, including the introduction of lapping paste into the lubricant. This was picked up by the bronze and the worm suffered severe wear, but the wheel was practically unmarked. Overload tests were carried out to several times the normal output torque, but abrasive wear did not occur, and eventually the worm threads fractured. Only when the unit was completely starved of oil could failure similar to the service condition be reproduced. Investigations confirmed that the unit had been operating in cold temperatures below the pour point of the oil and this had evidently resulted in channelling and eventual starvation. Use of lubricant with a sufficiently low pour point solved the problem.

The tooth efficiency of worm gears decreases rapidly as the ratio of the unit increases, and it is usually of much greater magnitude than churning and bearing losses. Since the tooth loss is proportional to the coefficient of friction it can be seen that it is important to have a low friction coefficient value for a worm gear lubricant. Disk tests provide this information for the slide/roll conditions expected. It is also necessary to choose materials which because of their mutual insolubility have inherent properties of low coefficient of friction. A phosphor bronze wheel running with a case hardened steel worm is the most common material combination, although nickel bronze, aluminium bronze, and cast iron have been used. En. 8 steel as a wormwheel material is unsatisfactory, scuffing occurring as soon as load is applied even when an EP oil is used as lubricant. Sulphur-impregnated En. 8 steel, however, is suitable as a wormwheel material for special applications, but it has a coefficient of friction double that of the bronze/steel combinations.

Choice of Lubricant for Worm Gears

Because wormwheel materials are usually of the bronze group the selection of a lubricant is simplified. The empirical expression used for spur and helical gears becomes $\frac{100\ Sc}{Vp}$ and the viscosity of a suitable oil determined from a similar table, Table II.

TABLE II

WORM GEARS

$\frac{100\ Sc}{Vs}$	*Up to* 5	5 *to* 14	14 *to* 30	30 *to* 60	60 *to* 100	*Above* 100
Approximate viscosity of oil cS at 60 C	30	45	70	100	150	250

Instances sometimes arise, however, where a heavily-loaded slow-running wormgear is to run with a high-speed helical gear. This occurred recently on an epicyclic test gear, the planet carrier of which was revolved by a worm and wheel to act as a differentiating device. A light oil which would carry heavy loads was called for and a mild EP oil of light grade which had been proved non-corrosive to bronze was decided upon.

Dip lubrication is the method favoured for worm gears, but where pitch line speeds become high, above about 2500 ft/min, then a jet of oil played on to the teeth becomes advisable. Only rarely are EP oils required in worm gears, and then usually for some special application. If it is decided to use them care must be taken to ensure that the bronze of the wheel is not liable to corrosion. Some of the latest EP additives suitable for helical gears are permitted for worm gear lubricants, although they are not beneficial to the latter type of gear. Synthetic oils are being increasingly used with worm gears because of their low coefficient of friction which results in much reduced running temperature.

Extreme Conditions

The normal ambient temperatures for gear units in Britain is between freezing point and 100 F. Sometimes, however units are required to run outside this range and special considerations have to be made. For low-temperature operation the lubricant is required to remain fluid at a low starting temperature, but not to become too thin at the operating temperature. In other words its viscosity index must be high. To meet certain extreme conditions some lubricants have been synthesized, and although at present they are more expensive than the natural petroleum products, the choice of one of these could well be justified.

With the advent of supersonic missiles and aeroplanes a great deal of interest in U.S.A. has been taken in lubrication problems at elevated temperatures. The lubricant must resist oxidation and other high temperature effects, which result in deterioration and metal corrosion, and at the same time possess satisfactory lubricating properties. Tests have again indicated that synthetic oils may be suitable, notably oil of the silicone group. These oils possess a high viscosity index and are exceptionally resistant to oxidation and sludge formation. Their drawback, however, is their rather poor lubricating properties compared with more conventional oils and their resulting tendency to promote wear which makes them generally unattractive as gear lubricants.

The future trends in oils are probably quite obvious. Thinner oils with higher load carrying capacity and lower coefficient of friction are required. As described above an empirical method of choosing the correct grade of oil is extremely successful in practice, but much work remains to be done to determine the precise relationships between the many variables.

Sufficient information has been gained however to be able to choose an oil with confidence for all the usual gear applications. For extreme conditions the synthetic group of oils possess additional properties which as they become proved by testing in service will probably be used more frequently.

Acknowledgment

The author wishes to acknowledge his indebtedness to David Brown Industries Ltd for permission to use information derived from their experimental work.

NIOC PIPELINE UTILIZATION

The NIOC pipeline network is reported to have carried a total of 1,443,623 ton/kilometres of products in 1960. This was 125,342 ton/kilometres or 9·5 per cent over the 1959 total of 1,318,342 ton/kilometres.

Personal Notes

Charles Hull, M.A., M.Inst.Pet., of Shell Refining Company Ltd has been appointed general manager, Stanlow refinery, in succession to **C. R. Middleton**, G.M., B.Sc., F.Inst.Pet., who retired recently after 35 years service with the Royal Dutch/Shell Group of Companies.

Charles Hull

Mr Hull joined The Anglo-Saxon Petroleum Company Ltd in 1937. His recent appointments include assistant manager of the Shell Petroleum Co. Ltd's Oil Products Development Department in 1955, becoming manager the following year. He was general manager in Sumatra from 1958–1960, when he returned to the U.K. to take up an appointment as manager, Staff Department, and deputy to the personnel director, Shell Refining Co. Ltd.

C. R. Middleton joined the Royal Dutch/Shell Group of Companies in 1925 and had been a director of Shell Refining Co. since 1955. He was awarded the George Medal in 1940 in recognition of his bravery and resource displayed during an air attack on Shell Haven refinery.

Arnold F. Kaulakis has been elected a vice-president and member of the board of directors and executive committee of Esso Research and Engineering Company, and will be responsible for the engineering operations of the firm.

Mr Kaulakis has been with the Company since 1942 and has contributed to the development and improvement of various petroleum refining processes, including fluid catalytic cracking and hydroforming techniques.

J. McNelly, Mobil Oil Co.'s Scottish retail branch manager, recently completed 40 years service with the Company. To mark the occasion he was entertained to lunch by the directors, and J. C. Gridley, Mobil's chairman, presented him with a gold watch.

J. McNelly

Mr McNelly started his career as an office boy with the Glasgow branch of what was then the Vacuum Oil Co. Ltd. From there he graduated to the Scottish sales staff and in 1947 became manager of the Specialities Department in London. Two years later he returned to Scotland, and was appointed to his present post in 1959.

The board of directors of Gulf Oil Corporation has elected two executive vice-presidents and a senior vice-president, **I. G. Davis** and **J. E. Bounds**, and **B. R. Dorsey**, respectively.

Dr Gilbert B. Carpenter has been retained by Mobil Chemical Company as technical adviser. He will be based in Rotterdam and will gather information on new products and processes, and will advise the Company on the expansion of its chemicals production and research activities.

C. G. C. Redman

New Total Directors

Four new directors have been appointed to the board of Total Oil Products (G.B.) Ltd.

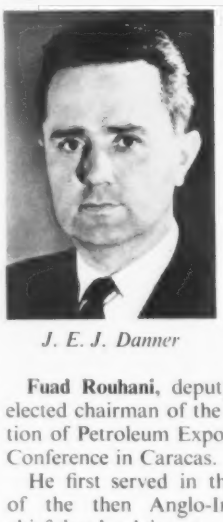
C. G. C. Redman is now director and chairman of the board of directors. Previously he was general manager and had been an alternate director of the Company since its formation in August 1955. Prior to that he was with the Burmah-Shell Co. Ltd in India.

L. J. Barnett has been appointed a director and managing director. He was, for a number of years, a director of the Standard-Vacuum Oil Co. (East Africa) Ltd of Nairobi, and upon his retirement from that company last year he became managing director of the Milford Docks Company, Milford Haven, a position which he vacated in order to take up his new duties.

L. J. Barnett

Also appointed directors are **P. L. Burgin** who is a partner in the firm which acts as the Company's solicitors, and **J. E. J. Danner**. Mr Danner is the representative of the Compagnie Française des Pétroles in London. He is also a director on the boards of the Iraq Petroleum Co. and its associate companies, Abu Dhabi Marine Areas Ltd, and Iranian Oil Participants Ltd. He holds the Croix de Guerre and the Légion d'Honneur.

P. L. Burgin



J. E. J. Danner

Abbas Parkhideh, senior adviser to the board of directors of National Iranian Oil Company has been appointed chairman of the board of directors of the Iran-Pan American Oil Company, which is jointly owned by NIOC and Pan American International. Mr Parkhideh will continue in his advisory capacity in NIOC.

Fuad Rouhani, deputy managing director of NIOC, was elected chairman of the board of governors of the Organization of Petroleum Exporting Countries at the Second OPEC Conference in Caracas.

He first served in the legal and administrative branches of the then Anglo-Iranian Oil Company and became chief legal adviser to NIOC after the nationalization of

the oil industry. In this capacity he was instrumental in drawing up the agreement between Iran, NIOC, and the Consortium. In 1954 Mr Rouhani was appointed to the board of directors of NIOC, and in 1956 he was nominated deputy to the chairman of the board.

Richard Adams

Richard Adams, M.I.Mech.E., M.I.Chem.E., M.B.I.M., A.M.I. Civil E., A.F.Inst.Pet., has been appointed general manager of a newly-created Engineering Division of Castrol Ltd.

He joined Castrol last year, and was previously chief civil engineer of Monsanto Chemicals Ltd, a project manager at Kellogg International Corp, and manager of the Mechanical and Electrical Engineering Division of George Wimpey & Co. Ltd.

Four new directors have been appointed to the board of Fletcher Miller Ltd, a member of the Castrol Group of Companies. They are **J. R. Bickerton,** chief chemist at Fletcher Miller's Hyde (Cheshire) plant, **J. Birchenough,** works manager at Hyde, **R. A. Miller,** North London divisional sales manager, and **S. V. Tilley,** senior technical representative for the Midlands and South Wales.

C. G. M. Smith

C. G. M. Smith has been appointed lubrequipment manager of the Castrol Division of Castrol Limited. He joined Castrol in 1925 and was appointed a lubrequipment representative in 1933, and field technical manager in 1959.

Sydney Porter has been appointed Engineer Commodore of the BP Tanker Company's fleet following the retirement of **P. J. Hyde,** O.B.E.

Mr Porter joined BP Tanker Co. Ltd as a junior engineer officer in 1923. He became chief engineer in May 1939 and was appointed one of the Company's senior post chief engineers early in 1957. Mr Porter has served in super tankers since 1952 and is at present chief engineer of the Company's flagship *ss British Queen.*

John Hall Grubb, vice-president and manager of the International Division of Cameron Iron Works Inc., died on 25 January in Houston, Texas, after an illness of several months. Born on 13 October 1905 in Eagle Grove, Iowa, he went to Texas as a young man, but spent a large part of his life in oilfields throughout the world. Employed by Cameron Iron Works since 1955, he was for the past two years vice-president and manager of the Company's International Division. He resided at the Plaza Hotel in Houston and had a host of friends in international oilfield equipment circles.

James R. Britt has been named vice-president and general manager of Universal Oxidation Processes, Inc, subsidiary of Universal Oil Products Co.

He was previously vice-president of Procon Incorporated, Universal Oil Products' construction subsidiary, and general manager of Procon (Great Britain) Ltd.

Joseph W. Smith has been appointed director of contract operations, Kellogg International Corporation, London. He takes over from **B. W. Jesser,** who has been named assistant vice-president and director of engineering of The M. W. Kellogg Company in New York.

Joseph W. Smith

Mr Smith, an assistant vice-president of M. W. Kellogg, will direct all operations of contracts awarded to Kellogg International Corporation for the engineering and construction of refineries, petrochemical and chemical plants.

A graduate engineer of the University of Michigan, Mr Smith has spent his entire professional career with Kellogg. Starting as a field engineer in 1936, he became chief field engineer in 1939, and was subsequently appointed resident manager of construction, manager of construction, and then director of construction.

F. Sargeant became the new managing director of Woodfield Rochester Ltd recently.

N. R. Dent, A.M.I.Mech.E., has been appointed manager of the Fisher Governor Company.

He joined Elliott Brothers (London) Ltd in 1957 as establishment manager at the Company's Rochester factory. Previously he was works director at Engineering Productions (Clevedon) Ltd. He served his apprenticeship with Dennis Bros Ltd and was for three years in charge of a department at the Production Engineering Research Association.

F. Nicholson, M.Inst.Pet., who was formerly with Shell International Petroleum Co. Ltd, was recently appointed assistant managing director of the English Drilling Equipment Co.

W. H. Pawsey, M.A., has been appointed a director and secretary of the Company.

J. A. Hulme, B.A., B.Sc., F.Inst.Pet., formerly general manager in Trinidad of Texaco Trinidad Inc, has been appointed general manager, Foreign Operations (Eastern Hemisphere), Texaco Inc, in New York.

G. Davidson, B.Sc., F.R.I.C., M.Inst.Pet., who, on his recent retirement from his position as vice-president (manufacturing) of Shell Oil Company of Canada, accepted an assignment with the International Labour Office has now taken up residence in Dacca in East Pakistan. Previously it was announced that he had been assigned to Central America.

Airdrill International Inc. of Denver, Colorado has announced the following appointments:

A. G. G. de Chastelain, D.S.O., O.B.E., B.Sc., M.Inst.Pet., as vice-president in Calgary, where he is also vice-president and general manager of Wellsite Air Services Ltd.

Fred J. Jobst, vice-president of Val R. Wittich Inc, becomes New York City contact representative.

Branch of The Month Feature

During a recent tour of the Branches, the General Secretary, rather timorously, suggested to the first Branch he visited that if each Branch of the Institute, in turn, took on the communal responsibility of preparing a high-quality article, which would reflect some interesting or unique feature of that Branch's locality or history or special work, there must be some extraordinarily interesting stories to be told.

The surprisingly enthusiastic welcome to this suggestion was such that the General Secretary (rather less timorously) put the idea up to each of the other Branches and the article from the Northern Branch is the first of the series.

The Northern Branch

Perhaps one thing may be said of petroleum men—that they have a propensity for doing the right thing at the right time. As the wind changes so comes the vogue for centralization or decentralization, but the wind was favourably north in 1936 when the Northern Branch of the Institute of Petroleum was formed. What of the area which the Northern Branch serves:

"Any corporate or student member of the Institute whose home or business address lies in the counties of Cumberland, Northumberland, Lancashire, Westmorland, Durham, Yorkshire, Derbyshire, or Cheshire, who applies for membership of the Branch shall be considered a member of the Branch subject to etc., etc.". Thus was the territory of the Northern Branch defined at its inauguration.

What led to the formation of another nucleus within the Institute? The then Lord Mayor of Manchester, Alderman Thomas S. Williams, said that Manchester was a city open to development of any trade or activity which was good for the country as a whole, and it was in that spirit of broad-mindedness that on behalf of the civic authorities of Manchester he gladly welcomed Sir John Cadman and the decision of his Institution to form a Northern Branch of petroleum technologists.

An impressive view of the School of Chemical Engineering in Manchester

Sir John Cadman said that the occasion was unique in the Institution's history in that it was providing a means of stimulating active discussion and exchange of views between oil men in a great oil consuming centre such as had grown up in and around Manchester.

The first chairman of the Northern Branch, H. C. S. Fothergill, said that the inauguration of the Branch would lead to decentralization through the formation of further sections in other parts of the north of England.

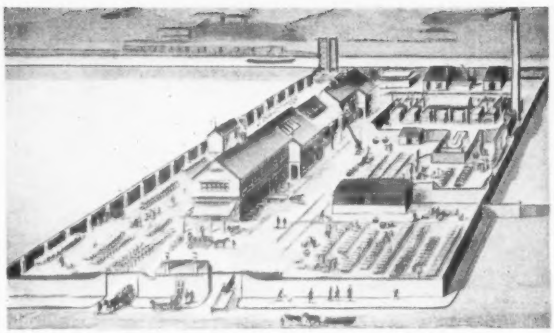
Perhaps it was not with the historic background in mind that the group of founder members acted, but well they might have done. The north can fairly claim some contribution to the history of petroleum refining and to have led the field.

Some years before Drake drilled his first well in America, crude oil was being won and processed in England by James Young. James Young was born in Glasgow in 1811 and in due course was apprenticed to his father, a cabinet maker. He studied chemistry at evening classes at the Andersonian University, now the Royal Technical College, Glasgow, and later he occupied the post of laboratory assistant and then lecturer. When his professor, Thomas Graham, was appointed to the Chair of Chemistry at University College, London, Young went with him. After two years in the London laboratory, Young was engaged as manager of Muspratts Chemical Works near Liverpool, where he pioneered the use of cast iron vessels in the manufacture of alkalies.

In 1844 he entered the service of Charles Tennant & Co., pioneers of the heavy chemical industry. In December 1847 a former fellow student, Professor Lyon Playfair of the Royal School of Mines, wrote acquainting him of a seepage of petroleum recently discovered. "You know that mineral naphtha is a rare natural product, no spring of it occurring in this country, all being imported from the continent and Persia. Lately a spring of this valuable product has been discovered on an estate belonging to my brother-in-law near Alfreton, Derbyshire. It yields at present about 300 gallons daily. The naphtha is about the consistency of thin treacle and with one distillation it gives a clear colourless liquid of brilliant illuminating power. It dissolves caoutchouc easily. Does this possibly come within the province of your works? If it do I will send you a gallon for examination."

Tennants gave Young permission to deal with this on his own and in 1848 the commercial exploitation of this petroleum was begun. A young chemist named Meldrum was

put in charge, the capital being supplied by E. W. Binney, a young lawyer and an able amateur geologist. The main products from this enterprise were lubricants and illuminating oils for the Manchester cotton mills. It showed that there was a real demand for mineral oil but dwindling flow gave warning that the supply from the Riddings Colliery was inadequate and Young turned his attention to the production of oil from coal.



Pendleton Oil Works in about 1860

With a claim to serve an area where petroleum refining was born, what can the Northern Branch look back on as regards distribution. The refining history, important though it is in the general field, is a minor factor in the formation of the Branch. Oil was being imported into Britain before Young's time and one finds in existence to-day firms whose names have lived in the distribution business since those early days: Thomas Moscrop & Co., founded in 1838, and John A. Bremner & Co., founded four years later. Indeed Bremner can claim to have been one of the first oil refiners in the full sense of the word. Pendleton Oil Works, with its coal-fired retorts and distillation plants, must have been an impressive sight just over 100 years ago.

1894 witnessed the opening of the Manchester Ship Canal and in 1897 appeared the Esso Mode Wheel Installation to set a new pattern of distribution in the Manchester area. The importance of the Ship Canal may be gauged from the fact that 70 per cent of British industry lay within 100 miles of its terminus. During these early years the oil was transported in casks and unloaded into storage sheds whence the distributors moved it by cart and rail to their customers. Casks gave way to barges and eventually tankers appeared on the scene, the products being pumped direct from the vessels into storage tanks for reloading into casks, barges, or rail-wagons. In order to protect their installation against the risk of fire, the Ship Canal Co. drew up stringent regulations, low flash material receiving special attention in that only small barge loads were allowed in the upper reaches of the Canal. No wonder that the emphasis in the Northern Branch is on lubricants rather than on fuels. Nevertheless, it was in the Northern Branch territory at Hale, in Cheshire, that the first kerbside garage and motor spirit pump was introduced for retailing gasoline to the public.

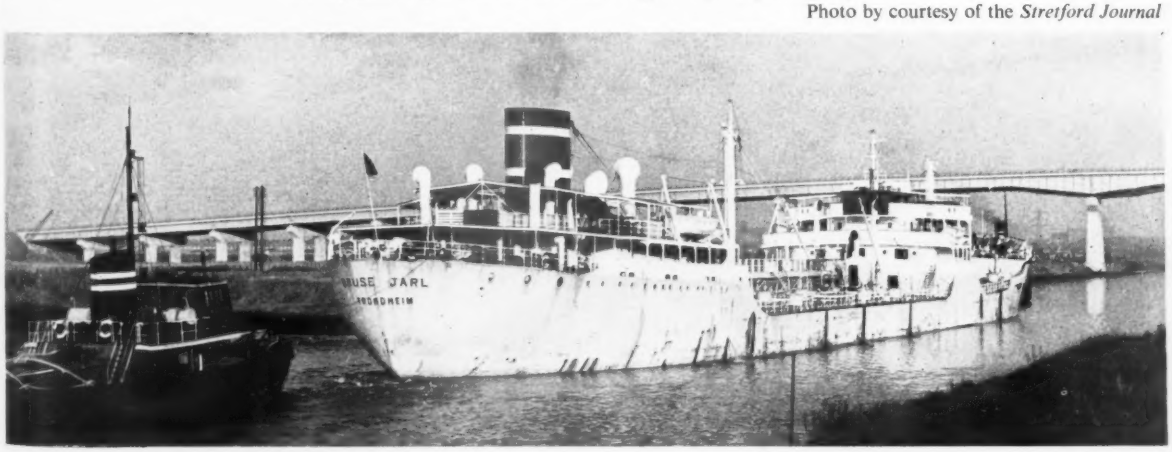
The Shell refinery at Stanlow and the Lobitos refinery at Ellesmere Port are some distance from Manchester but they were originally linked with the Northern Branch and have grown up with it. Nearer at hand are the Berry Wiggins and Manchester oil refineries. In 1948 a plant was erected at Partington for the manufacture of petrochemicals and a secondary output in gas being supplied to Manchester. In 1957 it was claimed that this plant was the largest and most modern of its kind in Europe and since then considerable development has been undertaken.

In the academic history of Manchester, where one finds the birth of modern chemistry, one can find little of interest relating to petroleum. Twenty-five years ago Professor A. H. Gibson said that while they in Manchester did not necessarily compete with the petroleum school in Birmingham he hoped at least that there would ultimately be found some reflection in the University of his city. To-day this reflection is to be seen in the School of Chemical Engineering under Professor Frank Morton.

In the 25 years of its existence the Northern Branch has attempted to make itself worthy of the industry which it represents and to fulfil some if not all the hopes of its original members, many of whom are still closely associated with the Branch and its activities. At least one of the prophecies made at the inaugural meeting has been amply fulfilled—Stanlow and Yorkshire branches represent "sections in other parts of north England" which H. C. S. Fothergill suggested would result from the formation of the Northern Branch.

Seventy per cent of British industry lay within 100 *miles of the terminus of the Manchester Ship Canal when it was opened nearly seventy years ago. The scene below is typical of the present day.*

Photo by courtesy of the *Stretford Journal*



Lectures, Courses, and Conferences

Institute of Welding Spring Meeting

The 1961 Spring Meeting of the Institute of Welding will be held in London between 25–28 April to coincide with the Engineering, Marine, Welding, and Nuclear Energy Exhibition at Olympia. The theme of the meeting will be Recent Developments in the Welding and Allied Processes.

The Fourth Annual Lecture will be given to coincide with the Spring Meeting by Dr N. P. Inglis. The subject of the lecture will be Welding in the Non-Ferrous Field.

Details may be obtained from the Secretary of the Institute at 54 Princes Gate, Exhibition Road, London, S.W.7.

One Day Symposium at Birmingham

The Midland Branch of the Institution of Chemical Engineers is holding a one-day symposium on 12 April in the Chemical Engineering Department of Birmingham University, under the chairmanship of Professor F. H. Garner, O.B.E.

Titles of lectures to be given include: Fabrication and Properties of Some of the Newer Constructional Metals, Recent Developments in Wrought Corrosion Resistant Nickel-Base Alloys, Plastics in Chemical Engineering and Building, Glass Fibre Wound Luminates, and Recent High Temperature Ceramics.

Registration fee, including pre-prints, to non-members is £1 11*s* 6*d*. Registration forms are available from the honorary secretary of the branch, T. R. Bott, at the Chemical Engineering Department, Birmingham University.

The Development of Fluid Fuel Reactors

Dr Alvin M. Weinberg of Oak Ridge National Laboratory will present a paper on the Development of Fluid Fuel Reactors at a meeting of The Institution of Chemical Engineers on 24 April 1961, at 5.30 p.m. This meeting is to be held under the auspices of the British Nuclear Energy Conference, and will take place at the Federation of British Industries, Tothill Street, London, S.W.1.

Courses for Works and Plant Engineers

A new series of courses on the latest developments in the firing and handling of solid fuel in industrial plants and commercial premises are planned by the National Industrial Fuel Efficiency Service during the next few months.

Each course will include sessions covering a short revision of combustion principles, the maintenance of boilers, mechanical stokers and firing equipment, and the choice of suitable fuels. There will also be a comprehensive introduction to the latest combustion equipment and automatic controls for industrial and commercial solid fuel users. Course syllabuses may be obtained from NIFES, 71 Grosvenor Street, London, W.1.

Standards Engineers Conference

The seventh annual conference of engineers and others concerned with the application of standards will be held on 9 and 10 May. The first day will consist of plenary sessions at the Connaught Rooms, London. The second day's programme, to be held at British Standards House, will include three parallel sessions, both in the morning and in the afternoon, to discuss various topics in smaller groups.

Details can be obtained from the British Standards Institution, British Standards House, 2 Park Street, London, W.1.

Combustion Engineering

A residential refresher course will be held at Prestatyn Holiday Camp from 29 May to 3 June, 1961 for engineers concerned with the burning of substantial tonnages of solid, liquid, and gaseous fuels on boilers and furnaces.

The inclusive fee for the course will be 12 guineas. Director of studies will be W. Short, B.Sc., M.Inst.F., and brochures and application forms can be obtained from C. K. R. Davies, National Industrial Fuel Efficiency Service, Baltic House, Mount Stuart Square, Cardiff.

International Plastics Exhibition

Over 350 firms from thirteen countries will be displaying their products at the International Plastics Exhibition in London's Olympia from 21 June–1 July 1961.

The exhibition is being organized by *British Plastics* and *International Plastics Engineering* with the co-operation of the British Plastics Federation. Tickets can be obtained from Iliffe Exhibitions Ltd, Dorset House, Stamford Street, London, S.E.1.

International Chemistry Congress in Montreal

The Eighteenth International Congress of Pure and Applied Chemistry is to be held in Montreal from 6–12 August 1961. It will be preceded by the 21st International Conference of Pure and Applied Chemistry which takes place between 2–5 August.

The Congress will consist of five plenary lectures and some 50 invited sectional lectures as well as contributed papers. Main divisions are: Physical Chemistry, Applied Chemistry, Analytical Chemistry and Organic Chemistry Symposium.

Information about the Congress can be obtained from the Chairman of the Central Committee of the Congress at the National Research Council, Ottawa, Canada. Details of the Conference are available from Dr R. Morf, c/o Hoffman-La Roche & Co. Ltd, Bâle 2, Switzerland.

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MIDDLE EAST OIL PRODUCTION

	January
	Tons
Iraq Petroleum Co. Ltd	3,196,337
Basrah Petroleum Co. Ltd	908,149
Mosul Petroleum Co. Ltd	112,777
Qatar Petroleum Co. Ltd	719,441
Iraanse Aardolie Exploratie en Productie Mij	4,606,000
	Barrels
Arabian American Oil Co.	44,536,549
Bahrain Petroleum Co. Ltd	1,398,061
Getty Oil Co. and American Independent Oil Co. (Kuwait-Saudi Arabia Neutral Zone)	4,505,528

The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for January was 1,436,000 tons.

Crude processed at Aramco's Ras Tanura refinery during January was 6,836,618 brl.

Oil Development in Western Europe

The last OEEC general report on Europe's oil economy was *Oil—The Outlook for Europe*, published in September 1956, and covering developments in the area up to the end of 1956, with a survey of the possible future structure of European oil demand up to 1975. In the same year the Hartley Report of the Commission for Energy reviewed the problem of the shortage of energy supplies in Europe and the difficulties that might arise in the future from its growing dependence on imported fuel.

Following on from this latter report the Energy Advisory Commission of the OEEC, under Professor Austin Robinson, published in January 1960 a review of the future energy prospects in the light of developments since the Hartley Report. Now the changes which have taken place in the last few years in European oil affairs have made necessary a further complementary report solely on oil. This has now been published under the title *Oil—Recent Developments in the OEEC Area*.

As is pointed out the period covered by the report has been one of contrast. The previous increase in industrial activity was checked during 1956-58 with a resulting halt in the increase in total energy demand. Oil consumption, however, continued to grow. In 1955 oil supplied 21 per cent of Europe's energy needs; by 1959 its share had risen to 30 per cent. This increase in demand had been accompanied by an even greater rise in the potential production and transporting capacity for oil, with the result that there is now a greater freedom of choice of energy supplies than at any time since the war. In addition important changes are taking place in the economic structure of Europe—economic communities and free trade agreements—which may have an important bearing on Europe's future energy supplies. This changing pattern of energy development is comprehensively analyzed.

As well as tracing European oil development over the past few years some discussion is also given of possible future trends.

Between 1955 and 1959 total oil demand in the OEEC area (excluding Spain) rose from 100·3 million to 150·5 million tons. By 1965 it is thought that this will have risen to between 200 and 240 million tons with a level of 390 million tons being attained by 1975. The steady rate of increase in the demand for light products is likely to be maintained, whilst, although the consumption of heavy oils will continue to expand rapidly, it is felt that it may be at a less fast rate than in recent years.

With the very large potential growth of motor traffic in Europe a steady increase in gasoline consumption can be expected for many years ahead. The continuance of heavy taxation on motor fuels, the report emphasizes, which encourages the design of smaller passenger vehicles and engines with low specific fuel consumption, and the increasing use of diesel-engined road vehicles, are restraining the demand for gasoline.

The largest increases, it is estimated, are likely to occur in the sectors where there is most scope for new uses of oil—particularly in the use of the heavier products. Therefore it is expected that the faster increases in the use of gas/diesel and fuel oils, compared with motor gasolines, will continue for several years. Looking further into the future, however, it should be remembered that these oils are those most likely to be affected by the growth of nuclear power and the increased use of natural gas. The extent of their increase will depend on government policies as much as the factors of price and convenience.

On the much-discussed question of oil imports from Eastern Europe, which amounted to about 3 million tons of crude oil and 7 million tons of products in 1959, the report points out the increased emphasis on oil and gas development during the current U.S.S.R. Seven-Year Plan. This calls for an annual increase in output of 11 per cent, which would result in a production of some 250 million tons in 1965, and would leave an even larger margin for export than at present. This fact would be accentuated by the pipeline network now under construction from the Volga-Ural fields to the Soviet satellite countries, and which would have a final capacity of about 35 million tons by 1975.

The Oil Committee is unable to forecast specifically how Europe's oil supplies will be constituted in future years. The certain element is that by 1965 the proportion of total supplies obtained from the Middle East and Venezuela will be reduced whilst that from newer sources will have increased.

The increasing tendency towards larger, and therefore more economical refineries, is pointed out. The average size of a refinery in the OEEC area has grown from 1·2 million tons capacity in 1955 to 1·5 million tons in 1959, whilst the average size of new refineries now under construction is over 2·5 million tons.

The review of oil development in the OEEC area is supplemented by individual country studies and detailed statistical appendices. The book is priced at 15*s* and is obtainable in the U.K. from HM Stationery Office.

* * *

CRANKCASE LEAKS IN VEHICLE FUMES

In a report prepared for the Motor Vehicle Pollution Control Board of California by the Southwest Research Institute, San Antonio, it was stated that control of unburned vehicle exhaust fumes would not be enough to cut down the smog problem. Designers will have to stop other leaks which permit hydrocarbons to escape into the atmosphere.

Even the most efficient exhaust control device would only make the vehicle a little more than half safe. The automobile industry has recognized the importance of crankcase "leaks" and has already voluntarily taken design steps to reduce this smog source. As the crankcase emits both the unburned gas which escapes between the piston and the rings (blow-by) and the oil vapours, it has been suggested that these fumes be recirculated through the combustion system and a further attempt be made to burn them.

It is thought by the Institute, however, that although this would reduce the percentage of hydrocarbons vented into the atmosphere, it might also result in gummy deposits on valves and pistons. Instead it is suggested that the crankcase fumes be channelled to the afterburners and oxidized there with the exhaust gases. The Institute calls for further research on such a system, and also studies of gas escaping from the carburettor into the atmosphere.

Notes of the Month

Remote Control for Ocean-Bed Oil Well

A significant step forward in obtaining more oil and gas from the outer continental shelfs of the world has been made by Shell Oil Co. which has made the first underwater completion in the U.S.A. It is the result of several years' work by the Exploration and Production Research Division of Shell Development Company at Houston, Texas.

The well, drilled 8300 ft below the ocean floor in 56 ft of water, 35 miles off the Louisiana coast in the West Cameron Block 192 field, has been brought into production by remote control from the surface of the sea without the use of divers.

The technique makes it possible to place the equipment necessary for controlling the flow of crude oil and gas on the bottom of the sea over the completed well. Operations involved in "bringing in the well", and subsequent production operations, are all carried out by remote control from the surface of the water. The research work involved not only experiment with many types of underwater equipment and various operating ideas but also an extensive study of wave action, both surface and underwater. The technique will be further developed, and at present Shell are witholding details of the operation.

New Saharan Exploration Permit

A new permit to search for oil in the south-western French Sahara has been granted to Société des Pétroles de Valence in which the BP Group and the French company BRP each has a 50 per cent interest.

The permit, known as Hassi Labbar, covers an area of 19,500 sq km in the region near the border with Mauretania and the Spanish Sahara. So far five test wells have been completed. Currently, El Alendaia well No 1 is being drilled in the Oued N'sa permit area and has reached a depth of 6400 ft. In addition geophysical and geological parties are working in several of the permit areas.

Société des Pétroles de Valence already holds permits covering 30,740 sq km in various regions of the French Sahara.

Oil Search Ltd to Direct Operations

The British Petroleum Co. Ltd, Vacuum Oil Co. Pty Ltd, and Oil Search Ltd have reached agreement in principle for Oil Search to take over the direction, management, and control of the Australasian Petroleum Company and Island Exploration Company to continue the oil search in Papua. Under the agreement Oil Search will increase its holding from 15 per cent to 80 per cent in both companies by a transfer of shares, and will nominate three of the five directors on the boards.

Oil Search, which will undertake the next stage of exploration, is reported to be conferring with its geological consultants De Golyer and MacNaughton of Dallas, Texas, to plan the future programme. While these studies are being made, surplus equipment and installations are being disposed of and field personnel are being reduced to a minimum until drilling is resumed.

New BP Exploration Interest in Alaska

A new BP interest in the search for oil in Alaska has been announced. Sinclair Oil and Gas Corporation and BP Exploration Company (Alaska) Inc., have joined Richfield Oil Corporation in exploration operations in the Katalla-Yakataga area of the Gulf of Alaska. An option to acquire a one-half interest in the operation was exercised by Sinclair, and one-half of Sinclair's interest was assigned to BP Exploration Company (Alaska) Inc. Richfield will be the operator for the group.

Operations are being conducted under two development contracts covering approximately 1,060,000 acres granted to Richfield in 1959 by the United States Department of the Interior. These areas lie along the coast of the Gulf of Alaska east of Copper River and west of Icy Bay. A test well now being drilled has reached over 11,500 ft.

In northern Alaska on the Arctic Slope, BP Exploration Company (Alaska) Inc. holds leases and options totalling over 218,000 acres, and in southern Alaska a further 18,000 acres in the Copper River Basin. BP carried out geological work in the Arctic Slope area in the summer of 1960.

Esso's New Butyl Rubber Plant

The new Butyl rubber plant to be built at the Esso refinery at Fawley is expected to be completed by the end of 1962. It will have cost about £4·3 million and yearly output will be in the region of 30,000 tons. Construction is being carried out by Foster Wheeler Ltd.

F. J. Stephens, a managing director of the Royal Dutch/Shell Group of Companies, signs the agreement which grants exploration and production rights to Shell over an area of approximately 1500 square miles of the Persian Gulf off the coast of Kuwait. The Emir of Kuwait, who is sitting behind his desk, signed the 45-year agreement on behalf of his Government. The ceremony took place in his palace on 15 January.

A Shell party is now in Kuwait preparing for the exploration surveys which will take place this year. It is expected that the first exploration well will be started by early 1962

Major Expansion of Antwerp Refinery

A major expansion project costing £11 million is to be carried out at the Antwerp refinery of Société Industrielle Belge des Pétroles, which is jointly owned by BP and Petrofina. The project will give the refinery a total potential capacity of around 8 million tons/year compared with the present capacity of some 4 million tons.

The new units include a 100,000 bsd crude distillation unit with an associated gas recovery unit; a 9000 bd catalytic reformer for upgrading light distillates; a 10,000 bd hydrofiner for desulphurizing gas oil; and a 60 tons/day sulphur recovery plant. Capacity of the existing catalytic cracking unit is being raised from its present 12,000 bsd to about 15,000 bd.

The project is expected to be commissioned towards the end of 1962 and a new petroleum dock capable of accommodating the larger tankers which will be used for feeding the refinery, will be completed this year.

Work Starts on Belfast Refinery

The first exploratory site work for the construction of BP's Northern Ireland refinery at Sydenham, near Belfast, has started.

The initial operation is to be a series of test borings to find out soil conditions. These are expected to take about two months. Up to 30 holes, each with a maximum depth of 90 ft, may be sunk and, after laboratory tests in London, the results will be used in the detailed designing of the foundations for the processing units, buildings, and installations.

The refinery, the first in Northern Ireland, will have an initial capacity for handling 1,300,000 tons of crude oil annually. It is expected to be commissioned in late-1963 and will involve an initial investment of about £8 million.

Refinery Expansion in Australia

Plans are in hand to increase the total capacity of Australia's refineries to more than 4100 million gals crude/year. These entail the construction by Mobil Petroleum Co. of a new 409-million gals/year refinery at Hallett's Cove near Adelaide, and additions which will lift the capacity of the Kurnell refinery to 993 million gals/year.

Current capacity of Australian refineries is 3322 million gals crude/year. The biggest plant is the BP refinery at Kwinana, Western Australia with a yearly capacity of 1048 million gallons. Next is the Shell refinery at Geelong (638 million gallons), then the Kurnell (Sydney) refinery of Australian Oil Refining (588 million gallons), Mobil Petroleum Co.'s Altona refinery (549 million gallons), the Shell refinery at Clyde, N.S.W. (256 million gallons), BORAL's Matraville, N.S.W. refinery (217 million gallons), and Hamilton, Queensland also owned by BORAL (26 million gallons).

New Pilot Plant at Billingham

To improve facilities for rapid manufacture of tonnage batches of chemicals under development, ICI's Heavy Organic Chemicals Division is building a general-purpose pilot plant at Billingham.

Together with existing pilot plants, it will be capable of manufacturing most of the products planned for development in the next few years. Equipment is designed to carry out reactions such as alkylation, amination and condensation over a range of temperatures and pressures, with auxiliary equipment to treat the reaction products by unit operations such as washing, filtration, crystallization, drying, and distillation.

The plant is expected to be completed towards the end of 1962.

Socony Mobil's New Chemical Plant at Naples

Mobil Chimica Italiana S.p.A., a newly formed Italian chemical company affiliated with Socony Mobil Oil Company Inc., is to build a major plant at Naples to manufacture benzene, ethylbenzene, orthoxylene, and paraxylene.

Initial output is estimated at 130,000 metric tons/year, of which benzene and orthoxylene will account for over 75 per cent. The raw materials will come mainly from Mobil Oil Italiana's adjacent refinery, which is the largest in Italy.

First UOP Lomax Unit

The first UOP Lomax unit is being installed at the Powerine refinery in Santa Fe Springs, California. The Lomax unit is designed to produce about 115 volume per cent of gasoline from a straight run diesel oil and heavy thermally cracked naphtha stock. In addition to converting light distillates to gasoline, the process can change various other distillates—from kerosines to heavy vacuum gas oil—into either gasoline or a combination of gasoline and middle distillates. According to UOP studies, a wide range of product ratios is obtainable.

The Powerine refinery's Lomax unit is designed to produce 2537 bsd of C4-plus gasoline from a 440°–656°F boiling range diesel fuel and 200°–425°F thermally cracked naphtha blend. Charge capacity is 2200 bsd.

Hydrogen required by the fixed-bed process will be supplied by existing Platforming capacity plus a new Platformer of about 3000 bsd capacity being built concurrently with the Lomax unit. Lomax product in the C5–C6 range will be blended into high octane motor fuel, and dehexanized gasoline will be upgraded via the Platforming route.

Monsanto to Raise Polyethylene Production

Monsanto Chemicals Ltd is planning to increase the polyethylene output of its Fawley, Southampton, factory. New plant, which will become operational early in 1963, will raise the present capacity of 17,000 tons/year by nearly 50 per cent.

This will be the second expansion of the Fawley plant since it was commissioned in 1959 with an original capacity of 10,000 tons/year. And it is likely that further units will be added in the future as the market develops.

Shell's New Research Laboratory

"Shell" Research Ltd recently opened a new laboratory near Sittingbourne, Kent to be known as the Tunstall Laboratory. It will be concerned with the possible effects on man and other vertebrates of contact with products being developed by the Royal Dutch/Shell Group of Companies. It has four Divisions: Pathology and Pharmacology, Physiology, Chemistry, and Biochemistry.

The director is Dr C. G. Hunter who was formerly Professor of Physiological Hygiene, School of Hygiene, and Associate Professor, Banting and Best Department of Medical Research, University of Toronto.

Oil Production Experiments

Experiments which may assist the development of methods of producing some of the oil in the ground which cannot be recovered by established production methods, are to be carried out by BP at its Formby oilfield in Lancashire. The experiments are to be carried out in two stages. First there will be tests to find out whether sufficient air can be transmitted by the oil-bearing reservoir rock to permit underground combustion to be initiated and sustained.

When this stage has been successfully completed, the oil in the reservoir will be ignited in one borehole and allowed to burn under controlled conditions. The expectation is that part of the oil will be consumed to produce enough heat to render the remainder more mobile and capable of being produced at the surface.

Four air injection holes and one burning hole have been drilled at Formby and core analyses have been made to measure porosities and permeabilities of the reservoir rock and the nature of the fluids therein. The pipework has been designed and the experiment now awaits the delivery of the compressors required for the air injection tests.

Isoprene Rubber for UK Evaluation

Cariflex isoprene rubber, a stereospecific polymer of isoprene, having a close similarity to natural rubber, is now available for evaluation in the U.K. reports the Shell Chemical Co.

Shell in the U.S.A. was the first to produce isoprene rubber on a commercial scale. Its plant at Torrance, California, with a capacity of 18,000 tons/year came on stream in October 1960 and a second plant with double this capacity is to be built in the Mid-West.

In Europe an isoprene rubber plant is currently under construction at Pernis, near Rotterdam.

Iranian Pipelines Construction

Construction of the 480 km 8-in products pipeline from Shahroud to Meshed has begun. This is the second stage of the Tehran–Meshed products line which forms the eastern branch of the Trans-Arabian pipelines. On the last line, two additional pump stations were recently commissioned.

The line from Tehran to Shahroud has been completed and tested and became operational in January. The pumping station previously serving the Tehran–Qazvin pipeline has now been put into service on the new line.

Construction of the 140-mile 10-in gas line from Gachsaran to Shiraz is completed, while on the route for the proposed gas line from Sarajeh to Tehran the preliminary survey has been effected.

First BP Tanker Launching in 1961

The first tanker to be launched for BP Tanker Company in 1961—the *British Cormorant*—went down the slipway at Harland and Wolff's Belfast yard on 19 January. The new tanker is of 15,500 dw tons and will be used to carry finished petroleum products.

Two More Giant Tankers for Esso

Esso Petroleum Co. Ltd has signed contracts with Verolme United Shipyards, Rozenburg, Holland for the building of a 77,000-dw ton tanker. A contract for a similar tanker has also been signed with Kockums Mekaniska Aktiebol, A.G., Malmo, Sweden. Standard Oil Company (New Jersey) recently announced that 12 such vessels were to be built and these orders bring the total on order for Esso Petroleum Co. Ltd to five.

New Tanker Quay for Jarrow

Plans for building an additional tanker jetty at the Shell-Mex and B.P. Ltd ocean oil installation on the River Tyne have been approved. The new jetty will supplement the existing jetty, which is no longer adequate to cater for the increasing number of, and tonnage of, tankers calling at the installation.

The first stage of the project will cost some £300,000 and will be designed for tankers up to 18,000-dw tons. The second stage will be the removal of the old jetty and the extension of the new jetty, costing a further £300,000 to cater for tankers up to 28,000-dw tons.

The new tanker quay is additional to the major developments at the Company's Jarrow Installation which have cost £1 million since the war.

Liberian Registration for New Iranian Tankers

The names of the two newest and largest oil tankers to join the National Iranian Tanker Company's fleet are the *Farah Pahlavi* which was formally handed over to the Company on 25 January, and *Reza Pahlavi* which is due for completion in April.

The two tankers were ordered two years ago from Chantier de L'Atlantique at Saint Nazaire. The Company already owns two 33,000-dw ton tankers, and the two new ships bring the total tonnage of the National Iranian Tanker Company's fleet up to 173,000-dw tons. The new tankers will sail under the Liberian flag and will be managed in London by Iranian Marine Services, which is jointly owned by the National Iranian Tanker Company of Teheran, and Galbraith, Pembroke & Co. Ltd, of London.

The principal dimensions of the ships are:

Deadweight	53,050 tons
Draft	39 ft 3 in
Length overall	785 ft
Breadth	102 ft
Depth	53 ft

The vessels have a trial loaded speed of 17 knots on 19,000 shp developed by double-reduction geared steam turbines with French made Foster Wheeler type boilers which give a pressure of 600 psi at a temperature of 850° F.

Record Oil Traffic at Kent Refinery

In 1960 a record total of nearly 18 million tons of oil was handled by the jetties of BP's Kent Refinery. Some 2775 tankers berthed during the year to bring in crude oil or load refined products, and another 1680 ships berthed to take on bunkers. Since the refinery started operations in 1953, the Kent jetties have handled nearly 83 million tons of oil, and there have been more than 29,000 berthings by tankers, other ships, and barges. Most of the refined products produced by Kent Refinery leave by water, but there is also considerable road and rail traffic. Last year nearly 18,000 road tanker loads left the refinery, and more than 5000 rail tanker loads. Since the refinery was commissioned there have been over 117,000 road tanker and 19,000 rail tanker loadings.

Successful Year for Standard Jersey

A preliminary estimate puts consolidated earnings of Standard Oil Company (New Jersey) during 1960 at $688 million, an increase of 9 per cent over the final audited results for 1959.

Worldwide sales of petroleum products rose by about 5 per cent. Gross crude oil production, including natural gas liquids, was estimated at 2,513,000 bd for the year, and compared with 2,464,000 bd in 1959. Refinery runs in the United States in 1960 were reduced by 47,000 bd below the 1959 level. However, expanded refinery operations abroad, notably in Europe, brought refinery runs to an average of 2,864,000 bd for the year, which compared with 2,789,000 bd the previous year.

The preliminary figures show that capital expenditure by consolidated affiliates on property, plant, and equipment reached about $720 million in 1960, $9 million less than in 1959. Other expenditures made in the search for oil and gas were $200 million, about the same as in 1959.

Record Earnings for Gulf Oil

The earnings of the Gulf Oil Corporation in 1960 are reported to be the highest in the Corporation's history. They have been estimated at $330 million or £118 million which works out at about one cent per gallon of net crude and product sales. Capital expenditures during the year were $346 million equal to £124 million.

Earnings in 1959 were $290,467,000 (£104 million) and the 14 per cent increase in 1960 is attributed to greater domestic production of crude oil and natural gas, higher petrochemical sales in the USA, and continued emphasis on increasing efficiency.

The Corporations' earnings in operations throughout the world, represent an annual return of approximately 8·5 per cent.

Record Sales for Ampol in 1960

Sales of petroleum products by Ampol Petroleum Ltd of Australia rose by nearly 30 million gallons in 1960 to reach 225,007,833 gallons. This represents a fourfold increase since 1951.

The year proved an extremely active one for the Company. In April the first keel plate of a new 32,250-dw ton tanker costing £A4 million was laid in the Broken Hill Proprietary Co.'s shipyard at Whyalla. A new seaboard terminal, with an initial capacity of 3,900,000 gallons, was opened at Port Kembla, N.S.W., in September and two more are planned for Port Alma in Queensland and Geraldton, Western Australia.

Exploration activities in connexion with WAPET operations, in which the Company has a holding, included the drilling of three wells, Thangoo Nos 1 and 1A, and Barlee No 1, all in the vicinity of Broome, without any significant shows of oil or gas. Otherwise emphasis was mainly on seismographic work carried out in the Fitzroy-Canning Basin area of the Kimberleys, and also the Perth Basin.

Another Company highlight occurred at the beginning of the year. The new £A3½ million plant of B. F. Goodrich Australia Pty Ltd, in which Ampol has a 41·49 per cent interest, started production of tyres, tubes, and batteries which are being marketed throughout Australia.

Attock Oil Company Reports Increased Production

Due largely to the discovery of oil in the Jurassic formation at Dhulian in the Punjab, Pakistan, where a well is producing at a rate of 1100 bd, crude oil production of the Attock Oil Co. Ltd rose by 262,345 brl in 1960 to 1,859,867 brl. The pipeline connecting the Dhulian field with the Company's refinery at Rawalpindi is being duplicated to handle the increased production. This will also allow for further expansion later.

The refinery throughput at Rawalpindi averaged 6173 bd during the year of which 1182 bd was for the Burmah Oil Co.'s offshoot, Pakistan Petroleum Ltd.

Following the discovery of oil in the Jurassic zone at Dhulian, the Company's subsidiary, Pakistan Oilfields Ltd, is reconditioning a well previously drilled to the Eocene in an adjoining lease and deepening it to the Jurassic. Pakistan Oilfields Ltd is also jointly engaged with Pakistan Petroleum Ltd in tests in the Karsal area. From results obtained by four test wells it appears unlikely that oil will be found in commercial quantities.

New Storage Depot at Meshed

NIOC has signed a contract with Williams Bros (Overseas) Ltd for the construction of an oil storage depot at Meshed. It will cost 208 million rials (approximately £990,000).

The depot is to be built at the end of the new 580-mile Teheran-Meshed pipeline and will have a capacity of 55,000 cu m with facilities for loading road tank cars supplying Meshed and the whole of the Khorrassan province area. The new pipeline and depot are expected to become operational in January 1962.

Largest Dracone Yet

The latest and largest Dracone flexible, towed container for sea transport, containing 100,000 gallons of kerosine recently completed trials in the English Channel. It is 200 ft long with a diameter of 10 ft. It can carry any liquid that is more than 2 per cent lighter than sea water. And since there is no need for an air space to keep it afloat, there is no risk of an explosive mixture building up inside.

The largest Dracone on trial in Southampton Water

When loaded it has a freeboard above the water level of 22 in and a draught of 63 in, with a liquid load of 350 tons. When empty it weighs 6·3 tons. Filling is done through one connexion at the tail end and unloading is carried out by suction pump.

At the present time it is possible to build a Dracone up to 1000 tons liquid capacity, and within five years it is thought that it will be possible to build one with a capacity of 5000 tons.

The first demonstration in Australia of the Dracone flexible nylon barge was made recently in Cockburn Sound, Western Australia, using the facilities of BP's Kwinana refinery.

During the demonstration, which was arranged by Westralian Farmers Co-operative, the empty Dracone was first hauled off its reel into the water and pumped full with 35 tons of oil. It was then towed in the Sound by a 75 hp work boat. Later the Dracone was returned to the jetty, pumped clear of oil, and replaced on its reel.

BP Expands in Canada

The British Petroleum Co. Ltd now has over 800 retail outlets in Canada. The development of BP Canada's market area in the Provinces of Quebec and Ontario showed an impressive expansion during 1960, the sales of all products increasing by 67 per cent in comparison with 1959.

An important recent addition to BP Canada's marketing facilities is the new BP Quebec City marine terminal. The delivery of 200,000 barrels of products by lake tanker to fill the storage tanks at the terminal was just completed before the St Lawrence River froze for the winter.

BP Purchases in 1960

During 1960, BP Trading Ltd (BP's principal trading subsidiary) placed orders for materials, equipment, and services amounting to £17,430,000, an increase of over £5,000,000 on 1959. Of this, orders worth £14,328,000 were placed in the United Kingdom, 66 per cent of the total being for use overseas.

In addition refineries and other main subsidiaries of BP placed orders in the United Kingdom during the year valued at £4,546,000.

Materials were shipped to 47 countries in approximately 26,000 consignments amounting to 106,000 tons at a freight cost of about £930,000. This involved the use of vessels of more than 200 shipping companies. In addition some 4200 air freight shipments were made at a cost of £64,000.

Measuring the Acceleration of Research Cars

An accelerometer capable of recording changes in a vehicle's speed occurring in a thousandth part of a second has been designed by the engineers at Shell's Thornton Research Centre. The need for such an instrument became apparent during recent studies of the comparative performances of various motor fuels when it was found that the driver's reaction to the acceleration of cars using these fuels did not agree with the measurements made by observers using stop watches.

Readings being taken from the tape record of a car under test at Thornton

To measure the acceleration of a car, a bicycle wheel is attached to the rear bumper and the time for each revolution of this extra wheel is automatically measured by the accelerometer and recorded on a paper tape, so that it is a simple matter to calculate the change of speed or acceleration. Engine acceleration is measured by connecting the accelerometer to the contact breaker of the car's distributor, and tape then records the time of each revolution of the engine.

In both cases the tape simultaneously prints a running record of the time elapsed since the acceleration began, making it possible to determine acceleration at any time during the speed change.

Chemical Exports in European Free Trade Area

The report of meetings on the European Free Trade Area origin rules held in London and Manchester in June 1960 by the Association of British Chemical Manufacturers has been published as a booklet under the title *Origin Rules, Certification and Segregation of Stocks*.

Unlike the Common Market countries who intend to introduce a common external tariff the seven countries of the European Free Trade Area will continue to operate their own external tariffs. This presents a danger that chemicals from outside countries could be exported into a low tariff member of the seven, and by re-export to the U.K. evade the 33⅓ per cent duty which would be payable on direct import.

It is to overcome this danger that certificates must accompany goods claiming reduced or duty free importation to show that they originated from within the area. Regulations concerning certificates of origin however, tend to be complex. In many cases, for example, it is necessary to know whether or not the starting material of a chemical export was made in the area, but similar information may not be required in exports not themselves classified as chemicals. Knowledge of the origin of dyestuffs is not required for instance when considering the origin of dyed textile piece goods.

The papers read at the June 1960 meetings are included in the booklet together with summaries of the discussions in which some fundamental questions are dealt with. The booklet gives a most effective explanation of the type, intention, and scope of EFTA origin rules for chemicals and allied products and can be obtained, price 3*s* 6*d*, from the Association of British Chemical Manufacturers, Cecil Chambers, 86 Strand, London W.C.2.

The Fire Protection Association

The name of the Fire Offices' Committee Fire Protection Association has been changed to The Fire Protection Association. It was established in 1946 to disseminate technical information about all aspects of fire protection and prevention. Its membership of 3800 includes some of the largest industrial organizations in the country and its publications and advice are frequently quoted in broadcasts and in the national press.

It is also hoped the new name will distinguish more clearly between the Fire Offices' Committee and the Fire Protection Association, but the deletion of the reference to the Fire Offices' Committee does not indicate any break in the relationship between the two bodies.

AFLAC Celebrates its Tenth Anniversary

To celebrate the tenth anniversary of the founding of the Admiralty Fuels and Lubricants Advisory Committee nearly 100 past and present members attended an informal dinner at the Café Royal on 25 January 1961.

Dr Charles Cawley, C.B.E., chief scientist at the Ministry of Power, presided and welcomed the guest of honour, Vice-Admiral J. M. Villiers, C.B., O.B.E., Fourth Sea Lord and Vice-Controller of the Navy. Other guests present included the Rt Hon. The Lord Geddes, C.B.E.; Vice-Admiral Sir Norman Dalton, K.C.B., O.B.E.; Vice-Admiral Sir Frank Mason, K.C.B.; Rear-Admiral I. G. Maclean, C.B., O.B.E.; Captain W. R. Stewart; Commander H. D. Nixon; Commander A. S. C. Sanderson; Dr F. T. Barwell; J. H. G. Carlile; Dr C. B. Davies; Professor F. H. Garner, O.B.E.; C. V. Hill, O.B.E.; H. F. Jones; W. H. Thomas; G. H. Thornley; E. J. Widdowson; and Dr D. Wyllie.

Books and Films

North African Oil Concessions

As further companies are granted exploration concessions in the present fastest-growing oil producing area of the world, North Africa, and further fields are located and developed the situation regarding the number of companies involved, and the complexity of affiliation of many of them, reaches nightmarish proportions for the seeker after knowledge. The well-known French habit of labelling many of the concerns entirely by their initials or a shortened form of their title is also not conducive to the ready understanding of the ramifications of the various national interests.

It is therefore greatly to the credit of the Petroleum Information Bureau that they have now published a list of North African oil concessions which should greatly help many both inside and outside the industry to dispense with the cold towels and black coffee.

Details are given of all companies holding oil concessions in Algeria (including the Sahara), Libya, Morocco, Tunisia, and the Spanish Sahara; the location of the individual concessions; and not least some particulars of the ownership of each company—although one could wish in a perfectionist fashion that a little more detail of the latter had been provided. These are supplemented by concession maps (which are keyed to the companies on the list) for the various countries. Having done such an admirable service in providing such information PIB makes copies obtainable free of charge, on application to their offices at 29 New Bond Street, London, W.1.

Statistical Compendium of Australian Oil

Last year an admirably comprehensive booklet of Australian oil statistics was published by the Petroleum Information Bureau (Australia). The latest edition, *Oil and Australia 1960*, is not only as instructive as its predecessor but is even broader in scope.

Entirely composed of tabulated statistics, it gives details of capital investment, petroleum products consumption, imports and exports, oil exploration, production and refining data, reserves, retail prices, and transport. Individual figures are provided in many of the tables for a run of previous years and for each of the states of Australia.

Presented in a handy fashion over 32 pages, *Oil and Australia 1960* is obtainable from PIB (Australia), 174 Swanston Street, Melbourne, Victoria.

Chemicals in Europe

During 1959 the countries of the OEEC bloc invested $270 million in their petroleum chemical industries, compared with $226 million in 1958. This was 22 per cent of the total investment in the area on all types of chemicals during the year. The United Kingdom and Germany each invested some $80 million, whilst approximately $50 million was invested in France and Italy.

In terms of carbon content, production of petrochemicals rose by 40 per cent in 1959 to reach 1,160,000 tons for the year. These and other facts are given in the 1959–60 edition of *The Chemical Industry in Europe*, published by the OEEC. It is estimated that in 1960 nearly 1,800,000 tons of petrochemicals were produced (in terms of carbon content). More detailed figures are provided on general trends in future developments, and the petroleum chemical plants in operation in 1959 are listed by their various countries. No data as to capacities is given, however. Supplementing this, petrochemical developments in each of the OEEC countries are briefly reviewed.

The petroleum chemicals content of the publication is only a very small part of its 220 pages, which covers the whole sphere of all types of chemicals within the OEEC area. It is obtainable in the U.K., price 17*s* 6*d*, from HM Stationery Office.

Availability of Tankers

The Westinform Service is publishing a separate section each month of its "Forecast of Availability of Shipping" dealing exclusively with tankers. For the purpose of analysis the world is divided into five zones, and tankers are examined in size groups and categorized as clean or dirty.

The forecast is available from W. G. Weston Ltd, 26–27 Cockspur Street, London, S.W.1.

British Chemicals and Manufacturers

The Association of British Chemical Manufacturers have issued a supplement to *British Chemicals and Their Manufacturers*, the directory which is published every two years and the last issue of which was dated 1959.

The supplement lists the many changes which have taken place since the 1959 directory was published and can be obtained free of charge from the Association at Cecil Chambers, 86 Strand, London, W.C.2.

Rubber Specifications

Rubber technology is advancing so rapidly that it is difficult for even a specialist to keep abreast of the full range of modern developments. Because of this the Federation of British Rubber and Allied Manufacturers has published a short *Guide to the Drafting of Specifications for Rubber Products*.

Copies, together with a series of useful customer requirement leaflets, may be obtained free of charge from the secretary of the Federation at 43 Bedford Square, London, W.C.1.

The BP Touring Service in 1961

The 1961 edition of the BP Touring Service, which contains information in a plastic hold-all for tourists who travel by car, is now available from BP service stations in the U.K. price 7*s* 6*d*.

This year it includes a novelty item—a Children's International Travel Log to help the child traveller to keep a record of his journeys. Among the other items in the Kit is a book of tokens, one for each of 13 European countries. Each token can be exchanged at a BP Service Station in the country for a free En-route kit of a map and useful touring information; an application form for the free BP Touring Service Insurance; a foreign language phrase book; and the BP Touring Guide to Europe.

A Century of U.S. Petroleum Statistics

An extremely valuable compendium of statistics on the mineral industries of the U.S.A. has been published by Resources for the Future Inc, 1775 Massachusetts Avenue, N.W., Washington, D.C. It gives a complete tabulated picture of the subject from as far back as reliable records will allow.

The petroleum section of *Historical Statistics of Minerals in the United States* lists crude oil production, average value at well, imports and exports, and estimated proven reserves for each year from 1859 to 1956. Natural gas figures cover marketed production, average value at well, gas vented and wasted, used for repressuring, estimated proven reserves, and a breakdown of sectors of consumption. Details of both natural gasoline and LPG production and average value at plant are also shown through the years. Further tables list refinery input and output of petroleum products 1916–56 and product imports and exports 1920–56.

It is interesting to note that Resources for the Future Inc is a non-profit corporation for research and education in the development, conservation, and use of natural resources. It has been established and maintained by grants from the Ford Foundation.

Dangers of Flammable Gases

Flammable Gases, a new technical information sheet (No 3015) published by the Fire Protection Association, gives a table noting the fire hazard properties of 18 flammable gases commonly used in industry. Included in the table are the vapour densities, explosive or flammability limits, auto-ignition temperature, and the flameproof groups of these gases, as well as other useful information for fire prevention. Advice is also given on the best methods of combating a fire involving cylinders of gas.

Copies of the Technical Information Sheet may be obtained free of charge on application to the Fire Protection Association, 31/45 Gresham Street, London, E.C.2.

Motor Trade Law and Practice

Published by the Institute of The Motor Industry "The Law and Practice of the Motor Trade" contains about 300 pages of useful material on the broad aspects of the law in relation to the motor industry. It is comprehensive in its approach and should be of particular value to the garage owner and motor dealer. Its 29 chapters include such headings as Firms and Partnerships, Purchase of Premises, Storage and Use of Petrol, The Shops Act, Insurance, etc. Price is 21*s* (post 1*s* 6*d*) and it is obtainable from The Institute of The Motor Industry, 40 Queen's Gate, London, S.W.7.

High-Speed Flight

Since 1956 the Shell Film Unit has produced three important films on the subject of high-speed flight, these being: Part 1, *Approaching the Speed of Sound*; Part 2, *Transonic Flight*; and Part 3, *Beyond the Speed of Sound*. Now most of the information and demonstrations included in those films have been incorporated into a simplified version. Thus, in 21 minutes, the new film *High-Speed Flight* presents in Eastmancolor a useful introduction to the subject which can be readily absorbed by the layman who has some interest in the whys and wherefores of the problems involved in transonic and supersonic flying.

The film is available on loan from the Petroleum Films Bureau, London, or from the Scottish Films Office, Glasgow. Copies are available in 35 and 16 mm gauge.

DECHEMA Monographs

Volume 38 of the DECHEMA Monographs includes 16 papers presented at the DECHEMA annual meeting of 1959 dealing with new advances in chemical engineering. Other papers deal with molecular amplifiers, galvanic fuel elements, and the flotation of salts.

French and English abstracts are included with the volume which can be obtained, price DM 28 to members and DM 35 to others, from Verlag Chemie GmbH, Weinheim Bergstrasse, Frankfurt-am-Main.

U.S. Bureau of Standards Publications

A compilation of the more important U.S. National Bureau of Standards publications dealing with precision measurement and the calibration of standards has been published in three volumes under the general title of *Precision Measurement and Calibration*. Individual volumes are entitled *Electricity and Electronics* which is priced at $6.00, *Heat and Mechanics* costing $6.75, and *Optics, Metrology, and Radiation* which sells at $7.00.

Research Highlights, another recent publication of the U.S. National Bureau of Standards, gives an account of the Bureau's research and measurement activities in 1960. It is priced at 65 cents.

Copies of these publications can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. One-fourth should be added to the price to cover overseas mailing costs.

Communication in Industry

One of the major problems facing large-scale industry is how to maintain communication with employees through all management and staff levels.

Discussing this subject in *Picture Press*, the new house journal of the Pressed Steel Company Ltd, Robert Chapman, the group personnel director, describes some of the methods of communication and the difficulties associated with them.

He believes that house newspapers and magazines can play an important part in keeping employees informed of company activities. Direct discussion is also effective, he says, but in industry in the past this has often been frustrated because heads of departments have been unwilling, or unable to devote time, to discussing future developments with their assistants.

Formal consultative machinery can also be used to spread information among employees, but it has been known for a person with a company or political axe to grind to distort the information he passes on to his colleagues.

Picture Press is the third in a series of new or re-designed publications published by the Pressed Steel Company Ltd recently. It will circulate both inside and outside the company.

An Iron and Steel Miscellany

Second film in Shell-Mex and B.P.'s Industrial Notebook series is *An Industrial Notebook on Iron and Steel* and it gives some interesting titbits of iron and steel, old and new. For example a smelting furnace of 1779 is compared with modern blast and electric furnaces, the development of railway lines from 1767 to recent times is depicted, and some really ancient steam engines still in use are shown. Visits are also made to steelworks and to quarries and examples of the use of steel in modern buildings give some indication of the diversity of such uses. A very worthwhile production, in

black and white, running for about 28 minutes. Copies in 35 or 16 mm gauge will be available from Shell-Mex and B.P. Film Library from 1 June.

A Year's Work in Pictures

A layman glancing through *BP News in Pictures 1960* will certainly have his eyes opened to the international nature of the oil industry. There are photographs from so many different parts of the world in which the BP group is active that it will make a special appeal to the addicts of the travelogue.

Many of the scenes depicted are familiar ones to the oilman, but even everyday scenes make a fresh appeal when captured by a skilled camera. One of the highlights of the issue is a picture of the *British Queen* in a choppy sea during her trials off the Scottish coast, and there is one photograph taken from such an unusual angle that the sight of maintenance men at work on a refinery column commands a more than casual glance.

As the title suggests, *BP News in Pictures 1960* is primarily a pictorial review of the group's activities during the year, and while not all of the photographs have the same artistic interest they are excellent portrayals of the different phases of the Group's operations during 1960.

Book of the Year Highlights Youth

Each January the staff of Shell-Mex and B.P. Ltd receive a *Book of the Year* containing a review of company activities during the preceding 12 months, and featuring various aspects of the national life in which the Company plays a part.

The theme of the *1960 Book of the Year* is youth. Sir John Hunt has contributed a foreword, and, since youth and adventure are often inseparable, there are articles and stories featuring enterprising young people.

The section dealing with company operations gives a clear and concise summary of the year's events, and is an excellent way of ensuring that employees know something about the Company as a whole and not just the section with which they are personally concerned.

Petroleum at Its Most Basic

The increasing number of children's pictorial encyclopaedias, guides to learning, etc., has been extended by a newcomer in the field which is published in the form of weekly magazine instalments under the title *Knowledge*, and mainly intended for the 8–18 age group. Published by Purnell & Sons Ltd, each weekly edition costs 2*s*.

Each week the magazine contains nine simply written and colourfully illustrated articles on history, geography, and science which can be bound to form a complete encyclopaedia. The fifth production of the series includes a description of petroleum, its origins, its simple hydrocarbon structure, and descriptive illustrations on oil exploration, drilling, and refining.

Although the information is presented at the most elementary level, several of the statements in the text are by no means indisputable. For example, it is arbitrarily said that the specific gravity of petroleum is 0·8, and that its age is "from 15 to 440 million years." The height of a derrick is flatly put at 148 ft, and the products selected as examples of those obtained from petroleum are somewhat strangely chosen and by no means the most important. The map of the world's oil-producing areas is also somewhat misleading, such regions as the Philippines; Australia; and Baffin Island, Canada, being indicated as crude oil producers. The idea of such a publication is to be applauded but it would appear unfortunate that by not consulting the petroleum industry its information on this subject is not in keeping with the scholastic eminence of its advisory editorial board.

British Standards

Vapour pressure of liquefied petroleum gas and *Reid vapour pressure of petroleum products*, BS 3324 and BS 3325, are two additions to the series of test methods approved by the Institute of Petroleum and published in technically identical form as British Standards.

BS 3324 specifies a method for the determination of the gauge vapour pressure of liquefied petroleum gas products such as propane and butane and is technically identical with IP 161/59T. The method is primarily intended for use with samples which have vapour pressures not exceeding 300 lb/in^2 gauge at the temperature of test, but a modified version of the apparatus for use at higher pressures is included. Two variants of the method are described, differing in the temperature of the test. Method A is for tests at 100°F (37·8°C) and is applicable to samples of commercial propane and butane. Method B is for temperatures up to 149°F (65°C). Apparatus and procedure are specified in detail and sampling procedure forms the subject of an appendix.

The method specified in BS 3325 is suitable for determining the absolute vapour pressure of volatile, non-viscous petroleum products except liquefied petroleum gases, for which it gives low results. In a modified form it can be applied to blends containing alcohols or other water-soluble materials. It is technically identical with IP 69/60.

Apparatus and procedure, including sampling and the preparation of the sample, are specified in detail. In the calculation of the result it is necessary to apply certain corrections, and instructions for evaluating these corrections are included.

Copies of these standards may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. price 5*s* each, postage extra to non-subscribers.

Glossary of terms used in automatic controlling and regulating systems BS1523: Section Two: 1960. This revised Standard gives up-to-date definitions of the terms used in process industries for single closed-loop automatic control systems, and is illustrated by diagrams. Attempts have been made to avoid contradiction with American and Continental glossaries. Preferred terms only are given, as the comparative list of standard and non-standard terms included in the 1949 edition is no longer considered necessary.

Copies of the Standard may be obtained from the BSI, Sales Branch, 2 Park Street, London, W.1., price 6*s*, postage extra to non-subscribers.

Carbon steel pipe flanges for the petroleum industry BS 3293: 1960. This new British Standard specifies materials, dimensions, and marking for forged carbon steel slip-on welding and welding neck flanges, of nominal sizes 26 in to 48 in. Similar types of flanges of nominal sizes up to and including 24 in are covered by BS 1560.

Although there is no national American standard for steel flanges in the size range covered by BS 3293 the dimensions given are generally in accordance with the standard practice of the American Manufacturers' Standardization Society of the valve and fittings industry.

Copies of the Standard cost 12*s* 6*d*.

Petroleum Refining in Canada

Although two refineries ceased operations during 1959 the crude oil capacity of Canadian refineries rose by 25,855 bd, or 3 per cent, to 853,262 bd. This was largely due to the modernization of the Imperial Oil Ltd refinery at Calgary and the installation of a second crude unit at the Canadian Oil Companies Ltd refinery near Sarnia.

Catalytic cracking capacity in Canada at the end of 1959 was equal to 33 per cent of crude oil capacity, while catalytic reforming was equal to 16 per cent. Catalytic cracking has increased by 3½ times since 1945 and catalytic reforming by 13 times in five years. Sixty-five per cent of catalytic cracking capacity and over 60 per cent of catalytic reforming capacity is situated in Quebec and Ontario. The importance of these provinces as refining centres can be seen in Table I.

TABLE I

CANADIAN REFINERY CAPACITY BY PROVINCES IN 1959

Province	*Crude Oil capacity (bd)*	*Cracking capacity (bd)*
Quebec	265,000	134,100
Ontario	254,272	88,850
British Columbia	95,550	36,100
Alberta	90,960	38,125
Saskatchewan	63,610	37,792
Nova Scotia	49,000	13,500
Manitoba	33,220	12,600
North West Territories ...	1,350	—
New Brunswick	300	—
Canada Total	853,262	361,067

With the decline in demand for aviation gasoline caused by the advent of the turbine engine, alkylation capacity totalled only 4885 bd. However the call for higher octane ratings is resulting in a rising trend for the blending of alkylate in motor spirit.

The growth of the petroleum refining industry in Canada is best illustrated by comparing total crude runs to stills over the post-war period. The total for 1945 was 65,903,028 brl, and by 1959 had risen to 269,826,220 brl.

The percentage of indigenous crude oil received at Canadian refineries rose from 8·9 in 1945 to 56·6 in 1959. This latter figure had been fairly constant since 1954 because the large concentration of refining capacity in Montreal East region uses foreign crude exclusively. Venezuelan crude oil accounted for 64·1 per cent of total imports in 1959, Near and Middle-Eastern crude 32·8 per cent, Trinidad 2·9 per cent, and United States 0·2 per cent. The 40 refineries operating in Canada at the end of 1959 were owned by 22 companies. The locations of refinery capacities of the leading companies are shown in Table II.

During the six years from 1954 to 1959 refinery production rose from 159,787,000 brl to 270,149,000 brl. Table III contains a detailed analysis showing how this growth occurred.

TABLE III

REFINERY PRODUCTION

(*Thousand barrels*)

	1954	1955	1956	1957	1958	1959
Liquefied petroleum gases	1,635	1,833	2,781	2,938	3,248	4,420
Petroleum chemical feedstocks ...	993	2,189	2,481	3,573	5,105	5,164
Naphtha specialities	859	918	869	991	1,157	1,306
Aviation gasoline ...	517	933	804	669	650	669
Motor gasoline ...	68,927	75,858	82,400	87,704	86,966	96,281
Aviation turbine fuel	1,575	2,622	4,027	4,707	4,280	4,235
Kerosine, stove oil, and tractor fuel ...	9,799	11,108	14,216	12,845	16,623	13,920
Diesel oil	12,678	15,894	22,012	24,913	22,684	27,711
Furnace oil:						
No 2 & No 3 ...	23,514	28,426	35,454	37,215	38,710	46,701
No 4, No 5, & No 6	30,008	42,640	48,312	46,412	41,856	46,256
Asphalt	5,805	7,221	7,818	8,703	9,045	9,429
Coke*	749	2,011	2,167	2,153	2,258	2,626
Lubricating oils and grease	1,688	1,972	2,035	2,109	1,982	1,994
Others†	1,040	6,142	9,934	7,612	9,173	9,437
Total	159,787	199,767	235,310	242,544	243,737	270,149

* Includes catalytic carbon.

† Includes wax and cadles, still gas, unfinished and minor products.

These facts are among those contained in a Canadian Government booklet entitled *Petroleum Refineries in Canada, January 1960*. It includes a full list of refineries in Canada, types of plant and source of crude, storage capacities, crude distillation and cracking capacities, remarks on refinery history and expansion plans, refinery capacities of each province 1939–59, refinery production by products 1939–59, capacity of cracking and reforming plants to produce gasoline, and a map of oil and gas pipelines and refineries. Copies of the booklet are obtainable from the Mines Branch Publications Distribution Office, Department of Mines and Technical Surveys, Ottawa, Canada, price 25 cents.

TABLE II

COMPANIES OWNERSHIP OF CRUDE OIL CAPACITIES BY PROVINCES IN 1959 (bd)

Company	*Quebec*	*Ontario*	*British Columbia*	*Alberta*	*Saskatchewan*	*Nova Scotia*	*Manitoba*	*N.W. Territories*	*New Brunswick*	*Company total*	*Per cent of total of all Companies*
Imperial Oil Ltd	72,000	94,000	32,000	43,200	22,500	49,000	18,000	1,350	—	332,050	38·9
British American Oil Co. ...	45,000	55,350	18,000	14,400	13,500	—	—	—	—	146,250	17·2
Shell Oil Co. of Canada ...	60,000	—	20,000	—	—	—	—	—	—	80,000	9·4
Texaco Canada Ltd	59,000	—	—	12,000	—	—	—	—	—	71,000	8·3
North Star Oil Ltd	—	—	—	2,100	—	—	12,500	—	—	14,600	1·7
Canadian Husky Oil Ltd ...	—	3,572	—	7,990	3,010	—	—	—	—	14,572	1·7
Royalite Oil Co. Ltd and Royalite Hi-way	—	—	4,750	—	7,600	—	—	—	—	12,350	1·5
Others	29,000	101,350	20,800	11,270	17,000	—	2,720	—	300	182,440	21·3

Petroleum in Parliament

Government-Owned Pipelines

Sir Edward Boyle's written answer to G. R. Mitchison (Kettering) on 27 January drew attention to the fact that government-owned oil pipelines are rateable.

During the 1960–61 rating year payments to local authorities were £58,203. Rateable values are agreed jointly by the Treasury Valuer and the authorities concerned in accordance with the normal principles for determining rateable values of property. Payments are made at the full rate of poundage.

Sir Edward said that rates are not paid on unused pipelines and allowances are made where they operate much below the original capacity.

Nuclear Propelled Tanker

The report of the technical committee set up to consider the five tenders for a nuclear reactor and propelling machinery for a 65,000-dw ton tanker is expected soon. The Minister of Transport told Patrick Wall (Haltemprice) during question time on 1 February that the committee had almost completed its assessment and was then due to meet shortly to draw up its report.

The consortium of shipowners to operate the ship has not yet been formed.

Inland Energy Consumption

In terms of coal equivalent inland consumption of oil rose from 38 million tons to 65·6 million tons in the five years 1956–1960. During this time coal consumption fell from 214·1 million tons to 195·6 million tons. Total inland energy consumption was 253·4 million tons in 1956 and 264·0 million tons in 1960.

This information was given by the Parliamentary Secretary to the Ministry of Power in a written answer to W. N. Warbey (Ashfield) on 6 February. He said that inland energy requirements in 1961 were likely to be in the region of 270 million tons and may reach 300 million tons in the late 1960's. Competitive ability will determine the relative shares contributed by the various sources of energy.

Derv Fuel Oil Tax

Frank Allaun (Salford, E.,) raised the question of the tax on derv fuel oil on 9 February. He asked Anthony Barber, the Economic Secretary to the Treasury, if the Chancellor of the Exchequer was aware that the tax of 2*s* 6*d* a gallon, or 200 per cent of the basic cost, had been responsible for the steady contraction of bus services and the increase in bus fares, and was it not a shocking anomaly that, while oil for other purposes is entirely tax free, oil for bus services is burdened with this heavy tax.

Mr Barber however refused to be drawn on the subject except to say that he could not accept what Mr Allaun had said, although he did disclose that he was receiving a deputation from the Joint Fuel Tax Committee.

Gasification of Oil

The Minister of Power's replies to questions from Edwin Wainwright (Dearne Valley) on 13 February contained a number of interesting facts about the gasification of oil in Britain.

He said that research into this subject had cost an estimated £146,000 in 1957–58, and in three succeeding years the bill had been £249,000, £227,000, and £290,000. He forecast that the 1961–62 figure would reach £176,000.

The Minister said that the amount of oil used in the gas industry in each of the last four years was 450,000 tons, 750,000 tons, 890,000 tons, and 1,030,000 tons. The estimate for the current year was 1,150,000 tons.

Illuminations at Filling Stations

The increasing brightness of lighting at gasoline filling stations and its effect on road safety was raised during question time on 14 February. The Hon. T. G. D. Galbraith, Joint Under-Secretary of State for Scotland, said he was looking into the matter to see whether it was necessary for planning authorities to be given guidance on this subject.

Fuel and Power

During a debate on fuel and power on 20 February opposition speakers made what amounted to a plea for a national fuel policy directed to the preservation of coal.

Ray Gunter (Southwark) referred to a number of authorities who forecast a shortage of oil by the turn of the century and spoke of the dangers he felt would face any nation without indigenous fuel resources of its own. He said the time may come when the closing of the so-called uneconomic pits would be regretted. He spoke about the drift of miners away from the industry and asked the government to set a realistic figure for coal production for some years ahead to let miners know there will be stability in the industry.

Dual-fired electricity generating stations burning oil, he said, should be converted to coal and a tax should be imposed on heavy fuel oil. Mr Gunter also wanted an investigation into the price of imported fuel as well as a review of the pricing policies of the oil companies.

Richard Wood, the Minister of Power, said he was opposed to fixing the coal industry's market on three main grounds. He felt it would lead to higher energy costs, that it would involve some kind of control of consumption, and that planning responsibility would be switched from the nationalized industries to the Government.

He felt that fuel policy must lie between a course of protection and unrestricted freedom which is unlikely to take account of national security and the balance of payments. The government had already banned imports of coal except from the sterling area, and imposed restrictions on oil from Soviet bloc countries. The programme of oil-fired power stations had been modified and the gas industry had undertaken to give coal first refusal when gas-making projects were being considered.

The Chancellor of the Exchequer was also under pressure the following day when several members also asked for a tax on fuel oil. But since Budget Day was then only a matter of weeks away, and he was governed by the traditions forbidding him to disclose its contents, he could do little more than say he would keep the matter in mind.

CORRECTION

We regret that, due to an error at our printers, the two photographs at the foot of page 76 in some copies of the March issue became transposed during production so that each bore an incorrect caption.

World Tanker Launchings in 1960

Oil tanker tonnage launched throughout the world fell by 726,453 tons in 1960 to 335 ships of 3,648,800 gross tons according to *Lloyd's Register of Shipping Annual Summary of Merchant Ships Launched during 1960.*

Seventeen per cent of all oil tankers were built in the United Kingdom, 16 per cent in Japan, 12 per cent in Sweden, and 11 per cent in W. Germany. Oil tankers represented 44 per cent of the world's output of merchant shipping compared with 50 per cent in 1959.

Fifteen of the 17 largest ships launched during the year were oil tankers. The largest ship was the *Universe Daphne* of 72,266 gross tons built in Japan for National Bulk Carriers of the United States.

Forty-six tankers of 618,372 gross tons were launched from British yards, which was 89,444 tons more than in 1959, which enabled Britain to replace Japan as the nation launching the largest amount of tanker tonnage during the year. The total comprised 18 steamships of 434,588 tons

TABLE 1

REGISTRATION OF OIL TANKERS LAUNCHED IN 1960

Country of Registration	*No*	*Gross Tons*	*Country of Build*	*No*	*Gross Tons*
Britain	55	853,275	Britain	41	533,729
			Belgium ...	1	13,315
			W. Germany ...	4	90,365
			Italy	1	23,015
			Japan	2	88,500
			Netherlands ...	4	52,351
			Sweden ...	2	52,000
Canada	1	26,968	Commonwealth	1	26,968
Other Commonwealth	2	18,840	Britain	1	18,200
			Italy	1	640
Argentina ...	3	15,700	Netherlands ...	1	12,700
			Unspecified ...	2	3,000
Belgium	1	31,489	W. Germany ...	1	31,489
Brazil	6	56,918	Denmark ...	5	34,903
			Japan	1	22,015
Denmark ...	6	87,658	Belgium ...	1	13,197
			Denmark ...	4	74,162
			W. Germany ...	1	299
Egypt (U.A.R.) ...	4	27,254	W. Germany ...	2	26,470
			Poland ...	2	784
Finland	3	16,191	Finland ...	2	3,323
			Netherlands ...	1	12,868
France	9	217,553	France	9	217,553
W. Germany ..	13	93,603	W. Germany ...	13	93,603
Greece	3	46,312	Netherlands ...	2	30,042
			Unspecified ...	1	16,270
Iraq	1	250	W. Germany ...	1	250
Israel	2	37,500	France	1	21,400
			W. Germany ...	1	16,100
Italy	14	258,796	Italy	14	258,796
Japan	121	164,820	Japan	121	164,820
Liberia	12	387,423	France... ...	3	108,316
			Italy	1	20,760
			Japan	4	154,214
Liberia—*cont.*			Sweden ...	2	52,593
			U.S.A.... ...	1	28,434
			Unspecified ...	1	23,106
Netherlands ...	15	166,460	Belgium ...	1	31,200
			W. Germany ...	6	3,309
			Netherlands ...	8	131,951
Norway	24	459,440	Britain... ...	3	44,584
			Denmark ...	1	13,450
			W. Germany ...	5	138,485
			Japan	1	30,250
			Netherlands ...	1	499
			Norway ...	4	36,254
			Sweden ...	9	195,918
Paraguay ...	2	2,460	Japan	1	1,374
			Spain	1	1,086
Panama	5	133,941	Japan	3	81,414
			Sweden ...	1	24,077
			U.S.A.	1	28,450
Poland	2	26,368	Poland ...	1	12,868
			Yugoslavia ...	1	13,500
Portugal	4	43,998	Japan	1	24,858
			Unspecified ...	3	19,140
Russia	2	29,046	Finland ...	1	3,330
			Japan	1	25,716
Spain	6	67,418	Spain	6	67,418
Sweden	5	84,600	Sweden ...	5	84,600
Switzerland ...	1	1,100	W. Germany ...	1	1,100
U.S.A.	9	240,690	Sweden ...	1	26,580
			U.S.A. ...	8	214,110
Venezuela ...	1	21,859	Britain... ...	1	21,859
Yugoslavia ...	3	30,870	Yugoslavia ...	3	30,870

Of the total of 335 tankers of 3,648,800 tons launched during the year, 246 of 1,989,435 tons were registered in the country of build.

and 28 motorships of 183,784 tons and represented 46·4 per cent of all merchant ship tonnage launched in Gt Britain during the year. Fifteen of the 19 largest ships built in Britain were oil tankers. The largest of these was the 41,800 tons *ss Serenia*, built by Vickers Armstrong (Shipbuilders) Ltd for Shell Tankers Ltd.

The tables give details of the registrations of tankers launched during 1960 and launchings during the year.

TABLE II

OIL TANKERS OF 100 TONS AND UPWARDS LAUNCHED IN 1960

Country of build	*Steam*		*Motor*		*Total*	
	No	*Tons gross*	*No*	*Tons gross*	*No*	*Tons gross*
Britain	18	434,588	28	183,784	46	618,372
Canada	1	26,968	—	—	1	26,968
Argentina ...	—	—	2	3,000	2	3,000
Belgium ...	1	31,200	2	26,512	3	57,712
Denmark ...	1	24,540	9	97,975	10	122,515
Finland	—	—	3	6,653	3	6,653
China (Nationalist) ...	1	23,106	—	—	1	23,106
France	9	288,518	4	58,751	13	347,269
W. Germany ...	11	315,842	24	85,628	35	401,470
Greece	—	—	1	16,270	1	16,270
Italy	11	298,822	6	4,389	17	303,211
Japan	15	485,493	120	107,668	135	593,161
Netherlands ...	6	137,455	11	102,956	17	240,411
Norway ...	—	—	4	36,254	4	36,254
Poland	—	—	3	13,652	3	13,652
Portugal ...	1	17,560	2	1,580	3	19,140
Spain	1	21,000	6	47,504	7	68,504
Sweden	6	175,749	14	260,019	20	435,768
U.S.A.	10	270,994	—	—	10	270,994
Yugoslavia ...	1	16,300	3	28,070	4	44,370
World total ...	93	2,568,135	242	1,080,665	335	3,648,800

W.O. APPROVED HD OILS

The following additional oils have been approved by the Director of Chemical Inspection, The War Office, as complying with the requirements of Defence Specification DEF-2101.

Supplier and supplier's nomenclature	*OMD grade of oil*
AB Nynas Petroleum:	
Ajcol MS 10W	40
Ajcol MS 20W/20	60
Aquila SpA Technica Industriale:	
Aquiloil HSD 110W	40
Beverol Fabrieken NV:	
Beverol Gold HD SAE 30	110
BP Trading Ltd:	
BP 2115	40
BP 2367	110
BP 2369	110
Castrol Ltd:	
Product H203/60	60
Compania Espanola de Petroleos SA:	
CEPSA-SAE-30-HD	110
Esso Petroleum Co. Ltd:	
—	60
—	110
—	330
G.E.R. Deurag Nerag:	
Nerag motorenöl HD SAE 10W	40
Nerag motorenöl HD SAE 50	330
Manchester Oil Refinery Ltd:	
Primorola HD 30 S	110
Maxima Lubricants Ltd:	
Maxima BL 10	40
Maxima AK 20	60
Maxima AM 30	110
Maxima AH 50	330
Mobil Oil AG:	
Motrex 105 SAE 30	110
Service des Essences des Armées:	
15 SAE-OMD	330
Shell International Petroleum Co. Ltd:	
Shell oil S.6020	110
Shell oil S.6002	330
Stevinson Hardy & Co. Ltd:	
SH 18	110
Vigzol Oil Co. Ltd:	
Avena 20	60

THE OIL REFINERIES OF BRITAIN

During the post-war period in Britain an outstanding economic feature has been the creation of a large oil refining industry to the point where it has the largest capacity in Western Europe and the third in size in the world. Since 1945 over £300 million has been spent on bringing refinery capacity to over 49 million tons at the end of 1960.

Before the second world war two-thirds of Britain's modest oil requirements were supplied by imports of refined products. Last year the output of products from U.K. refineries was of the order of 45 million tons, thus supplying the vast bulk of the nation's requirements.

Statistical details of the individual refineries operating in Britain to-day are provided by a recent memorandum from the Petroleum Information Bureau entitled "The U.K. Petroleum Refining Industry". A list of the refineries and their capacities is reproduced here. In addition a description of each refinery is given with particulars of its development and details of the various refining units. An appendix provides a short glossary of refinery process.

Copies are available from PIB, 29 New Bond Street, London, W.1.

Refinery	*Company*	*Capacity metric tons/year*
Fawley	Esso Petroleum Company Ltd ...	11,500,000
Milford Haven ...	... ...	4,500,000
Kent	BP Refinery (Kent) Ltd ...	9,000,000
Grangemouth ...	BP Refinery (Grangemouth) Ltd	3,100,000
Llandarcy	BP Refinery (Llandarcy) Ltd ...	3,000,000
Pumpherston ...	Scottish Oils Ltd	180,000
Shell Haven ...	Shell Refining Company Ltd ...	8,000,000
Stanlow	... ...	5,400,000
Heysham	... ...	1,900,000
Ardrossan ...	... ...	160,000
Coryton	Mobil Oil Company Ltd ...	2,000,000
Ellesmere Port ...	Lobitos Oilfields Ltd	210,000
Trafford Park ...	Manchester Oil Refinery Ltd ...	175,000
Kingsnorth (Kent)	Berry Wiggins & Company Ltd	160,000
Weaste (Lancs) ...	... ...	120,000
Dundee	William Briggs & Sons Ltd ...	45,000
		49,450,000

World Tanker Statistics Final Quarter 1960

Oil tankers under construction in the world's shipyards fell by 109,890 tons during the final quarter of 1960 to 229 ships of 3,925,474 gross tons. These comprised 96 steamships of 2,741,199 tons and 133 motorships of 1,184,275 tons, and represented 45·3 per cent of all merchant shipping then being built.

Tanker tonnage due for registration in Britain rose by 12,515 tons to 54 ships of 1,127,815 tons which was more than double the figure for any other country. Norway was next in line with 30 ships of 554,889 tons, followed by Liberia with 12 ships of 347,735 tons, nearly 179,000 tons below the figure for the previous quarter. Full details are given in Table I.

At the end of 1960 British yards were building 46 oil tankers totalling 806,527 gross tons, which was over 27,000 tons less than at the end of the third quarter. Tankers accounted for 47·6 per cent of all ships under construction in Britain.

Sweden followed Britain with 24 ships of 552,459 tons under construction. Japan moved up into third place over France and W. Germany with an additional 77,986 tons to total 33 tankers of 433,772 tons. Table II gives the complete picture.

Six new tankers were laid down in Britain's shipyards during the quarter, 16 were launched, and work on a further 12 was completed. Sweden started 6, launched 8, and completed 4. Japan started 35, launched 33, and completed 39. Launchings are analysed in Table III.

TABLE I

REGISTRATION OF OIL TANKERS UNDER CONSTRUCTION AT END OF DECEMBER 1960

Country of registration	*No*	*Gross tonnage*	*Country of build*	*No*	*Gross tonnage*
Britain	54	1,127,815	Britain... ...	40	670,227
			Commonwealth	1	21,000
			France... ...	1	50,000
			W. Germany ...	3	120,088
			Italy	1	23,000
			Japan	2	88,500
			Netherlands ...	1	21,000
			Sweden ...	5	134,000
Canada	1	4,000	Commonwealth	1	4,000
Other Commonwealth	2	18,650	Britain... ...	1	18,200
			Japan	1	450
Argentina ...	1	1,500	Unspecified ...	1	1,500
Brazil	3	21,325	Denmark ...	3	21,325
Nationalist China	2	4,800	Unspecified ...	2	4,800
Communist China	1	12,800	Poland ...	1	12,800
Denmark ...	2	49,000	Denmark ...	2	49,000
Finland	1	499	Finland ...	1	499
France	10	262,218	Denmark ...	1	21,500
			France... ...	8	211,718
			Netherlands ...	1	29,000
W. Germany ...	9	67,750	W. Germany ...	9	67,750
Greece	4	49,070	Netherlands ...	2	32,600
			Unspecified ...	2	16,470
Iran	2	67,410	France... ...	2	67,410
Iraq	2	500	W. Germany ...	2	500
Israel	1	21,400	France... ...	1	21,400
Italy	15	259,410	Italy	15	259,410
Japan	23	140,190	Japan	23	140,190
Liberia	12	347,735	Belgium ...	1	31,200
			Denmark ...	2	59,600
			W. Germany ...	1	13,713
			Italy	1	20,760
Liberia—*cont.*			Japan	5	148,082
			Sweden ...	2	74,380
Netherlands ...	11	197,561	Britain... ...	1	25,000
			Belgium ...	1	31,200
			W. Germany ...	3	30,399
			Netherlands ...	6	110,962
Norway	30	554,889	Britain... ...	3	62,600
			Denmark ...	1	13,450
			France... ...	1	500
			W. Germany ...	4	97,400
			Japan	1	30,250
			Netherlands ...	1	499
			Norway ...	10	158,440
			Sweden ...	9	191,750
Panama	4	102,250	Britain... ...	1	30,500
			Italy	1	17,000
			Japan	1	26,300
			U.S.A. ...	1	28,450
Paraguay ...	1	1,086	Spain	1	1,086
Poland	2	26,368	Poland ...	1	12,868
			Yugoslavia ...	1	13,500
Portugal	4	25,250	Unspecified ...	4	25,250
Russia (U.S.S.R.)	3	17,120	Poland ...	2	14,120
			Sweden ...	1	3,000
Spain	8	105,509	Spain	8	105,509
Sweden ...	6	122,749	Sweden ...	6	122,749
Switzerland ...	2	2,100	W. Germany ...	2	2,100
Turkey	2	1,020	Unspecified ...	2	1,020
U.S.A.	8	289,900	Netherlands ...	1	50,000
			Sweden ...	1	26,580
			U.S.A.... ...	6	213,320
Yugoslavia ...	3	23,600	Yugoslavia ...	3	23,600

There were 150 tankers totalling 2,199,282 gross tons out of the total of 229 tankers of 3,925,474 tons due for registration in the country of build.

TABLE II

OIL TANKERS UNDER CONSTRUCTION AT END OF DECEMBER 1960

Country of build	*Steam*		*Motor*		*Total*	
	No	*Tons gross*	*No*	*Tons gross*	*No*	*Tons gross*
Great Britain and N. Ireland	24	633,261	22	173,266	46	806,527
Other Com'w'lth Countries ...	1	21,000	1	4,000	2	25,000
Argentina ...	—	—	1	1,500	1	1,500
Belgium ...	2	62,400	—	—	2	62,400
China (National-ist)	—	—	2	4,800	2	4,800
Denmark ...	4	108,600	5	56,275	9	164,875
Finland ...	—	—	1	499	1	499
France	8	272,443	5	78,585	13	351,028
Germany (West)	11	323,801	13	8,149	24	331,950
Greece	—	—	2	16,470	2	16,470
Italy	11	294,610	7	25,560	18	320,170
Japan	8	252,132	25	181,640	33	433,772
Netherlands ...	6	177,262	6	66,799	12	244,061
Norway... ...	1	18,500	9	139,940	10	158,440
Poland ...	—	—	4	39,788	4	39,788
Portugal ...	2	23,560	2	1,690	4	25,250
Spain	2	43,000	7	63,595	9	106,595
Sweden ...	8	248,860	16	303,599	24	552,459
Turkey ...	—	—	2	1,020	2	1,020
U.S.A.	7	241,770	—	—	7	241,770
Yugoslavia ...	1	20,000	3	17,100	4	37,100
World total ...	96	2,741,199	133	1,184,275	229	3,925,474

TABLE III

OIL TANKERS LAUNCHED DURING THE FINAL QUARTER 1960

Country of build	*Steam*		*Motor*		*Total*	
	No	*Tons gross*	*No*	*Tons gross*	*No*	*Tons gross*
Great Britain and N. Ireland	7	160,880	9	48,947	16	209,827
Argentina ...	—	—	—	—	—	—
Belgium ...	—	—	—	—	—	—
Denmark ...	1	24,500	3	27,575	4	52,075
Finland ...	—	—	1	499	1	499
France	4	134,668	1	13,585	5	148,253
Germany (West)	2	69,888	6	4,208	8	74,096
Greece	—	—	1	16,270	1	16,270
Italy	2	56,300	3	2,190	5	58,490
Japan	3	81,250	30	30,205	33	111,455
Netherlands ...	—	—	3	37,799	3	37,799
Norway ...	—	—	1	12,300	1	12,300
Poland	—	—	—	—	—	—
Portugal ...	1	17,560	1	350	2	17,910
Spain	—	—	3	20,595	3	20,595
Sweden ...	1	32,000	7	137,844	8	169,844
Turkey ...	—	—	—	—	—	—
U.S.A.	2	56,760	—	—	2	56,760
Yugoslavia ...	—	—	—	—	—	—
World total ...	23	633,806	69	352,367	92	986,173

This information is included in *Lloyd's Register Shipbuilding Returns* for the quarter ended 31 December 1960. The report also shows that there were 5 oil tankers between 50,000–60,000 gross tons under construction, and another of nearly 70,000 tons, all of which were powered by steam turbines.

Equipment Developments

First Eight-String Christmas Tree

The Oil Centre Tool Co., of Houston, Texas has completed the first eight-string well-head assembly which is to be used on a multiple completion well in south Texas.

The unit was designed around standard components to support four strings of 2½-in tubing. The casing head was fitted with a free floating flange that does not require aligning pins. A quadruple master bushing supports threaded hangers for the 2½-in outside tubing string and four small tubing heads support the 1½-in macaroni strings.

New Bristol Siddeley Fan Engine

The Bristol Siddeley *B.S.75* is the first high by-pass ratio fan engine in the world to be designed as such from the start. It is expected to receive full certification early in 1964 and will later be installed in the Avro *771* and British Aircraft Corporation *107* airliners.

The ducted fan or by-pass engine is, in effect, a jet to which a fan has been fitted to act not only as a compressor for the air entering the combustion chamber, but as an airscrew which forces a considerable mass of air through the fan duct, by-passing the combustion chamber, to the rear of the engine. The ducted air travels more slowly than the jet efflux and remains a lot cooler, giving greater propulsive efficiency at low speeds and creating less noise.

The ratio of ducted air to combustion air determines the characteristics of the engine and is known as the "by-pass ratio", which in the case of the *B.S.75*, is 1·75 : 1.

The new engine will have a thrust of 7000 lb–8000 lb. Compared with a turbojet of the same size it is claimed to give 25 per cent more take-off thrust, a 50 per cent decrease in noise level, and a 15 per cent improvement in specific fuel consumption.

Neoprene Oil Boom Controls Sea Pollution

Further developments are reported in the use of floating inflatable oil booms to limit water pollution in the vicinity of loading or discharging oil tankers.

William Warne and Co. Ltd has designed and manufactured a boom made from neoprene synthetic rubber supplied by the Du Pont Company and reinforced with *Terylene*. Neoprene's resistance to petroleum products, sea water, abrasion, and weathering make it a particularly suitable material for such an application. It can also be used in confining burning oil to a controlled area of water, and has a weighted skirt hanging below the tube to prevent oil seepages beneath the boom.

Made in 50 ft lengths jointed together, the boom, when inflated, sits about 14 in above water level. In one form the boom can be quickly sunk to allow a vessel to pass over it and then refloated in a matter of minutes. A future development that is envisaged is the towing of such a boom between tugs to encircle oil patches floating out to sea.

Trade Literature, etc.

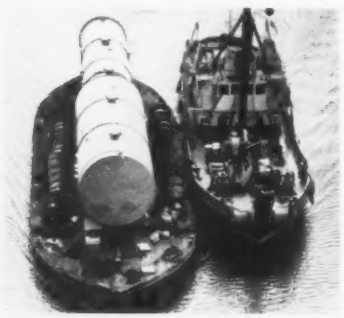
Brochure for Petroleum Refiners

A new brochure for petroleum refiners, giving a detailed description of Petreco Electrofining processes used to treat distillates and middle range oils, and the Company's Bender catalytic sweetening process for distillate treating is available from Petrolite Ltd, Heathcoat House, 20 Savile Row, London, W.1.

RAF Order for Richardsons Westgarth Group

Richardsons, Westgarth, and Co. Ltd has received an order from the Air Ministry for four 12,000 gpd sea-water vacuum flash evaporators, together with associated equipment to provide drinking water for RAF personnel at Sharjah in the Trucial Oman, and Masirah Island off the coast of Muscat and Oman.

They will bring the total daily output of Richardsons Westgarth evaporators in the Middle East to 2½ million gallons, sufficient to supply the needs of a town of 100,000 inhabitants.



This 85-ton crude fractionating column was just starting its journey to Mexico when this picture was taken. It was manufactured by Head Wrightson Teesdale Ltd for the new Minatitlan refinery

New Fuel Cell

The U.S. Navy's Bureau of Ships has awarded M. W. Kellogg Co. of New York, a contract to develop a chemical power plant based on a new type of fuel cell which operates on a mercury amalgam of sodium, oxygen, and water, and develops twice the voltage of hydrogen cells. The prototype will develop about 100 hp or 75 kW. It will be about 15 times lighter than standard electric batteries now in use, and will weigh between 2-3 lb/kW hr of capacity.

Pioneer work on the cell was carried out at Western Reserve University in 1953 by Dr Ernest Yeager and co-workers who found that a dilute solution, or amalgam, of sodium in mercury made a useful sodium electrode.

Explosion-Free Industrial Mixing

The explosion hazard which may occur when mixing certain volatile liquids and organic materials, is claimed to be entirely eliminated by the development of the Waring Explosion-Proof Blendor motor base which is being marketed in the United Kingdom by the Waring Division of Winston Electronics, Ltd.

The EP-1 model for the British market is wired for 230 volts. The power is 1/5th bhp, and the motor has two speeds—8000 and 16,000 revs/min, free-running.

British Fire Fighting Vehicles for Hungary

Following the visit of one of their senior executives to Hungary in 1959 the Pyrene Company received an order for four foam tenders, built on Thornycroft 4 × 4 chassis, and powered by Rolls-Royce B 81 Mk 50F/1 engines.

The Pyrene foam-making branchpipe equipment built into the tenders can deliver up to 6400 gals/min of foam with the maximum foam compound carrying capacity being 550 Imperial gallons. As an alternative to foam discharge, high pressure water jets may be projected for cooling-down purposes.

Catalogue of pH Meters

The complete range of pH meters manufactured by Electronic Instruments are described in *pH Meters by E.I.L.*

E.I.L. produced the first commercial direct reading pH Meter in the United Kingdom in 1947 and pH meters have been developed of such sensitivity that changes of 0·005 pH can be accurately recorded. The booklet is claimed to feature a complete range of pH Meters for every type of user. Copies can be obtained from the Company headquarters, Richmond, Surrey.

Honeywell Scanner for Saudi Arabia

Honeywell Controls Ltd is supplying a 40-point temperature scanner to watch bearing temperatures of a gas turbine compressor in an LPG plant at the Arabian American Oil Co.'s Abqaiq pumping station in Saudi Arabia.

If during 1-point-a-second scanning a point is found overheated, it sounds a klaxon, the scanner stops, and the jack of the appropriate point indicated on a Nixie lamp display, is plugged. This connects a precision indicator and individual measurement can be made while scanning resumes. A second plug connects any desired point to a strip chart recorder in the panel.

Clark Bros New Compressor

Clark Bros Co. Division of Dresser (Great Britain) Ltd has developed a modified version of its Model *TLA* gas engine driven compressors for the 1500–3000 bhp range. Designated Model *TBA*, the new unit with 17 in × 17 in bore and stroke will be built in five, six, eight, and ten power cylinder models rated at 1500 bhp, 1800 bhp, 2400 bhp, and 3000 bhp respectively. Existing TLA units are rated at 1700, 2000, 2800, and 3400 bhp.

Chemicals for Industry

Esso Petroleum Chemicals for Industry is a 16-page booklet giving brief details of Esso chemicals available in the U.K. Copies are available from the Chemicals Division of Esso Petroleum Co. Ltd, 50 Stratton Street, London, W.1.

Madan Airhydropumps

Hydraulic pressures required by industry and research establishments are higher every year and Charles S. Madan & Co. Ltd has added a new model to its range of *Madan Airhydropumps* which produces pressures up to 100,000 psi from compressed air at 80/100 psi. It is a reciprocating pump with an output of just over 6 cu in/min at 10,000 psi falling to just under 2 cu in/min at 90,000 psi.

Kellogg Ammonia Process

A new brochure describing the production of ammonia via steam reforming was published recently by The M. W. Kellogg Company of New York. Process descriptions and flow sheets for the basic ammonia process and for both one-stage and two-stage reforming operations are included in the brochure. Of special interest is an empirical formula developed by Kellogg engineers which enables the reader to calculate the quantity of feedstock required for any given rate of ammonia production.

Oilfield Pipe

The role of steel pipe in the oilfield section of the petroleum industry is interestingly conveyed in a new handbook entitled *Mannesmann Pipe in the Oilfield Service* and published by Mannesmann AG of Düsseldorf. Specially produced to meet the needs of foreign users, the book is in two volumes totalling 146 pages, and is profusely illustrated with photographs, diagrams, and charts.

The first volume, which describes the uses of Mannesmann pipe in oilfields, includes chapters on the manufacturing processes (together with the testing and inspection procedures) for seamless and electrically-welded steel pipe, the various steels used in pipe materials, and the different sizes and types of pipe used in the drilling for and extraction of petroleum. Each of the four kinds of pipe casing, drill pipe and tool joints, production well pipe, and line pipe are discussed at length. Tables of API specifications of dimensions, weights, material, etc., are given in each case.

The second volume, entitled *Useful Information for Oilfield Experts*, is addressed chiefly to the practical operator in the oilfield, and consists of a collection of calculations, tables, and charts of such things as joint casing strengths, internal pressure resistances, strength of materials, stresses, and safety factors, and API tables required by the drilling engineer for all pipe applications.

Industrial Heat Engineering

The six companies which comprise The Incandescent Group of Companies between them claim to offer a complete service in industrial heat engineering. The activities of the individual companies are described in a new booklet which can be obtained by writing to the Group headquarters at Cornwall Road, Smethwick, Birmingham.

Texan Companies Proposed Merger

Dresser Industries Inc, of Dallas, Texas, and Reed Roller Bit Co., of Dallas, Texas have agreed in principle on a plan under the terms of which Dresser will acquire the business and assets of Reed, as well as assume its liabilities.

Stainless Steel Tanks

An interesting point about two new articulated transformer oil tank trucks of which Mobil Oil Co. Ltd recently took delivery, is that the tanks, eliptical in section, are constructed from stainless steel plate to eliminate corrosion. Each unit contains three compartments of 500 gallons and one of 1000 gallons capacity. The semi-trailer tanks are coupled to Leyland Super-Comet tractors.

Anti-Scuffing Products

A new leaflet issued by Rocol Ltd contains four diagrams comparing the efficiency of molybdenum disulphide oils with straight lubricating oils and oil graphite mixtures. The leaflet describes the Company's *Anti-Scuffing Oil*, *Anti-Scuffing Paste*, *Anti-Scuffing Spray*, and *Anti-Scuffing Powder*.

Acid Pumps

It has been announced that the L. A. Mitchell Ltd range of chemical stoneware acid pumps is to be manufactured by Mitchell Craig Pumps Ltd of Glasgow, previously known as Craig Pumps Ltd.

Aluminium Pipe in Service

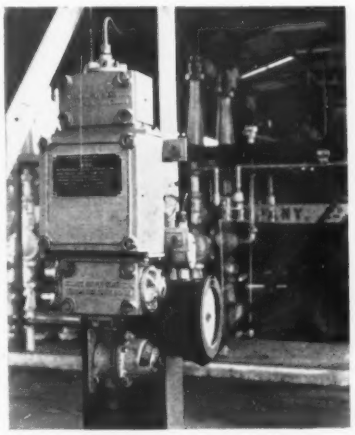
Examined recently after 12 years' service, Esso Petroleum Co.'s 8-in aluminium pipeline on the loading jetty at Purfleet used mainly to convey white spirit from tankers to the storage tanks ashore, was found to have suffered virtually no corrosion although it had carried some 430,000 tons of white spirit occasionally contaminated with other petroleum products and seawater.

No leakages occurred at the joints which were developed by Aluminium Construction Ltd. They were made by expanding the ends of the pipe into two internal square-cut grooves machined in the cast flanges and bolted up with asbestos gaskets. Within the pipe itself, the recent examination showed that a brownish friable deposit had accumulated, but corrosion was negligible.

The aluminium pipeline at Purfleet which was supplied by Alcan Industries Ltd

Fire Risks With Tank Wagons

Under the Petroleum Spirit (Conveyance by Road) Regulations of 1957 the accumulation of a dangerous static charge must be prevented when filling or emptying a road petrol tanker. This means that the vehicle and loading arm have to be earthed effectively, and this can be achieved by a new intrinsically safe transformer relay unit produced by the General Electric Co. Ltd to ensure proper earthing during an operation in which static electricity could be a danger.



The unit has a flameproof enclosure with incoming and outgoing terminal chambers, the main enclosure housing a certified intrinsically safe transformer and relay.

For use as an earth proving device, one side of the secondary output from the transformer is connected to earth, and the other side is connected via the operating coil of the relay to a trailing cable clipped to the vehicle. This means that the secondary circuit is complete only when the normal earthing cable of the vehicle is securely bonded to earth. A contact on the relay, which closes only if the earth continuity is satisfactory, can be used to control an indicator lamp, the operating coil of a pump motor starter, a solenoid valve controlling the flow of fuel or any other equipment which must operate only when the vehicle is properly earthed.

Electric Well-Logging Unit

A new, completely self-contained electric well-logging unit has been developed by Electro-Technical Labs, a division of Mandrel Industries, of Houston, Texas.

The new unit requires no additional equipment and can be used with standard-type probes. It is lowered into the hole on a simple wire line, where it can record two separate traces. Measuring 2¾in in diameter and 98in in length, the electric logging tool will replace truck-mounted equipment ordinarily required for the logging process.

Small Domestic Burner

An article on the subject of "smaller house" central heating is included in the latest issue of *Wiggin Nickel Alloys*. It features a new oil-fired boiler of the type which feeds hot-water radiators as well as all domestic hot-water supplies, the *Paulomatic Model 20* having an output of 20,000 Btu/hr. Oil burner parts in the hottest zone are made of *Incoloy DS* heat-resisting nickel-chromium-iron alloy sheet.

The publication is obtainable free on request from the Publicity Department, Henry Wiggin and Co. Ltd, Thames House, Millbank, London, S.W.1.

Honeywell Controls at Brazilian Refinery

The new Petrobras plant at Duque de Caxias, Brazil has, as a nerve centre of its eight processing units, what is believed to be the largest combined control panel outside the U.S.A.

Manufactured by Honeywell Controls, the instrument panels measure over 225 ft in length. Refinery operations are graphically portrayed on the panels, with instruments serving as part of the flow diagram. Honeywell has also supplied thermometers, flow meters, differential converters, transmitters, and other instruments external to the control centre.

Non-Ionic Surfactants

Croda Ltd has published a technical data sheet listing the properties of the Company's *Polychol* non-ionic surfactants. *Polychols* are polyoxyethylene condensation products of wool wax alcohols, and are available in five experimental grades.

Copies of the data sheet can be obtained from Croda Ltd, Cowick Hall, Snaith, Goole, Yorkshire.

New Anglo-American Company

Elliott Brothers (London) Ltd has a two-thirds controlling interest in the new company, Rotron Controls Ltd, which they have formed jointly with The Rotron Controls Corporation of Woodstock, New York to manufacture the range of flowmeters and associated equipment developed by the American company and to sell these instruments throughout Europe, the Middle East, and the Commonwealth, excluding Canada.

Company Change of Name

The Mond Nickel Co. Ltd, an affiliate of The International Nickel Company of Canada, has changed its name to The International Nickel Co. (Mond) Ltd. The new name is intended to identify the Company more closely with the Canadian company.

Paint at Hythe SR Plant

An article in a recent issue of *The Blundagon*, house magazine of the Blundell Spence Group of Companies, features the use of the company's primers and paints at the building of the International Synthetic Rubber Company's plant by Southampton Water.

Elektrik Tel-O-Set

The new *Elektrik Tel-O-Set* measuring and control system, which is being supplied for the 720-mile pipeline under construction in Northern India, is now available generally.

Honeywell Controls Ltd claim that it is the first system of its kind with true two-wire working. Direct current transmission of the signal at 4–20 milliamps is used along a pair of wires that also carry the 42 volt dc power supply.

Basic equipment comprises a transmitter, a 5½ in × 6 in receiver-controller and a valve operator. All field units work on the force-balance principle and operate in ambient temperatures of −40 F to +150 F.

SERVICES AVAILABLE

Drawing office design and tracing capacity available for piping, electrical and instrumentation installations for oil refineries and similar plants and projects. All work supervised by competent experienced engineers, apply by telephone Lee Green 3416 or write Wellen (Engineers) Ltd, 89 High Street, S.E.13.

FOR SALE

Waterfog and Waterspray Installations, automatic or non-automatic, designed and installed for Fire Fighting. Also complete Foam Installations. Fire Armour Limited, 9 George Street, London, W.1.

The Rheostatic Co.'s New Midland HQ

Lichfield House, a shop and office block on the Birmingham Ringway, is to be the new Midlands Headquarters of the Rheostatic Co. Ltd, a member of the Elliott-Automation Group.

Forthcoming Meetings

THE INSTITUTE

(*At 61 New Cavendish Street, London, W.1, 5.30 p.m.—tea 5 p.m.*)

New Ideas in Welding for the Petroleum Industry. V. I. Holmes and W. K. B. Marshall. **3 May**

IP LONDON BRANCH

(*At 61 New Cavendish Street, London, W.1, 6 p.m.—tea 5.30 p.m.*)

Construction of a Refinery from Grass Roots. W. L. Sullivan. **26 April**

IP NORTHERN BRANCH

(*At Engineers' Club, Albert Square, Manchester 2, 6.30 p.m.*)

Recent Developments in the Production of Olefins and Aromatics by Petroleum Cracking. M. Ruhemann, D. R. Cummings, and W. L. Seddon. **18 April**

IP STANLOW BRANCH

(*Lecture Theatre, Grosvenor Museum, Chester, 7.30 p.m.*)

Some Corrosion Problems in the Chemical Industry. D. Bennion, B.Sc., A.R.I.C., Dip.Chem.Eng., A.M.I.Chem.E. **19 April**

THE SOCIETY OF INSTRUMENT TECHNOLOGY

(*Belle Vue Hotel, Cheltenham, 7.30 p.m.*)

Instrumentation Developments in the Petroleum Industry. G. C. Eltenton, B.A., F.Inst.P., F.Inst.Pet. **19 April**

SITUATIONS VACANT

Geologists: Department of Scientific and Industrial Research. At least four pensionable posts in Geological Survey for men and women aged 21 and under 30 (31 for permanent members of Experimental Officer Class) on 1.7.61; extension for candidates with regular Forces service or Overseas Civil Service. Qualifications: normally 1st or 2nd class honours degree in Geology. National salary scale £738–£1,222. Starting pay may be above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley Street, London, W.1, for application form, quoting S/168/61. Closing date 19th April 1961.

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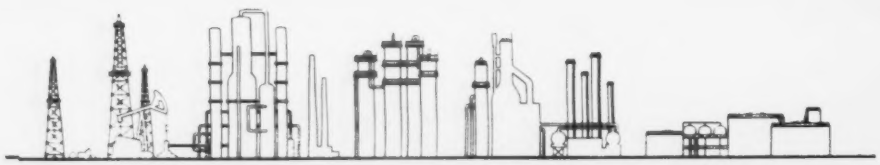

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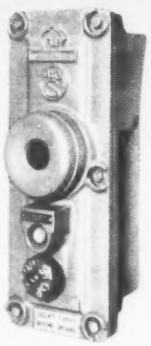

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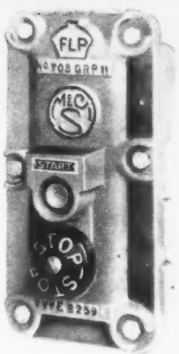

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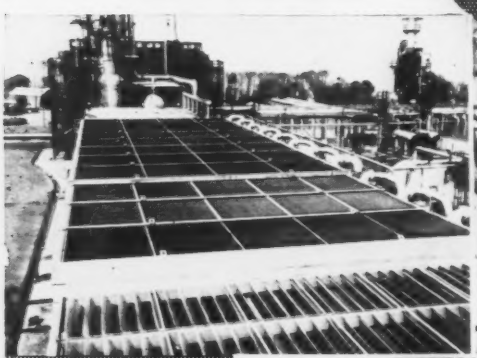

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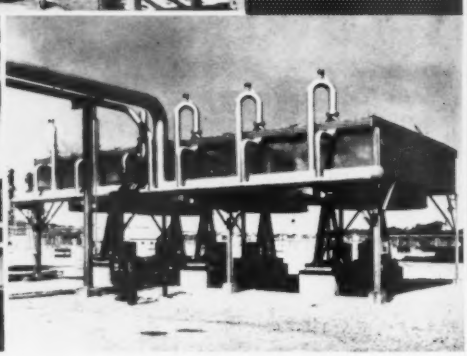

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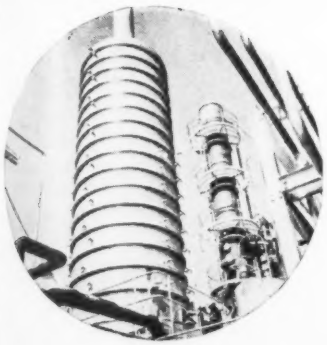

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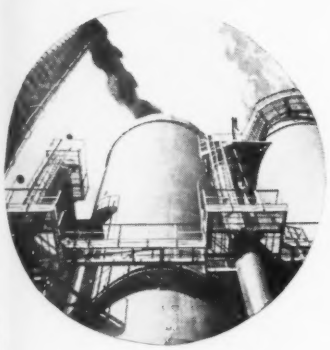

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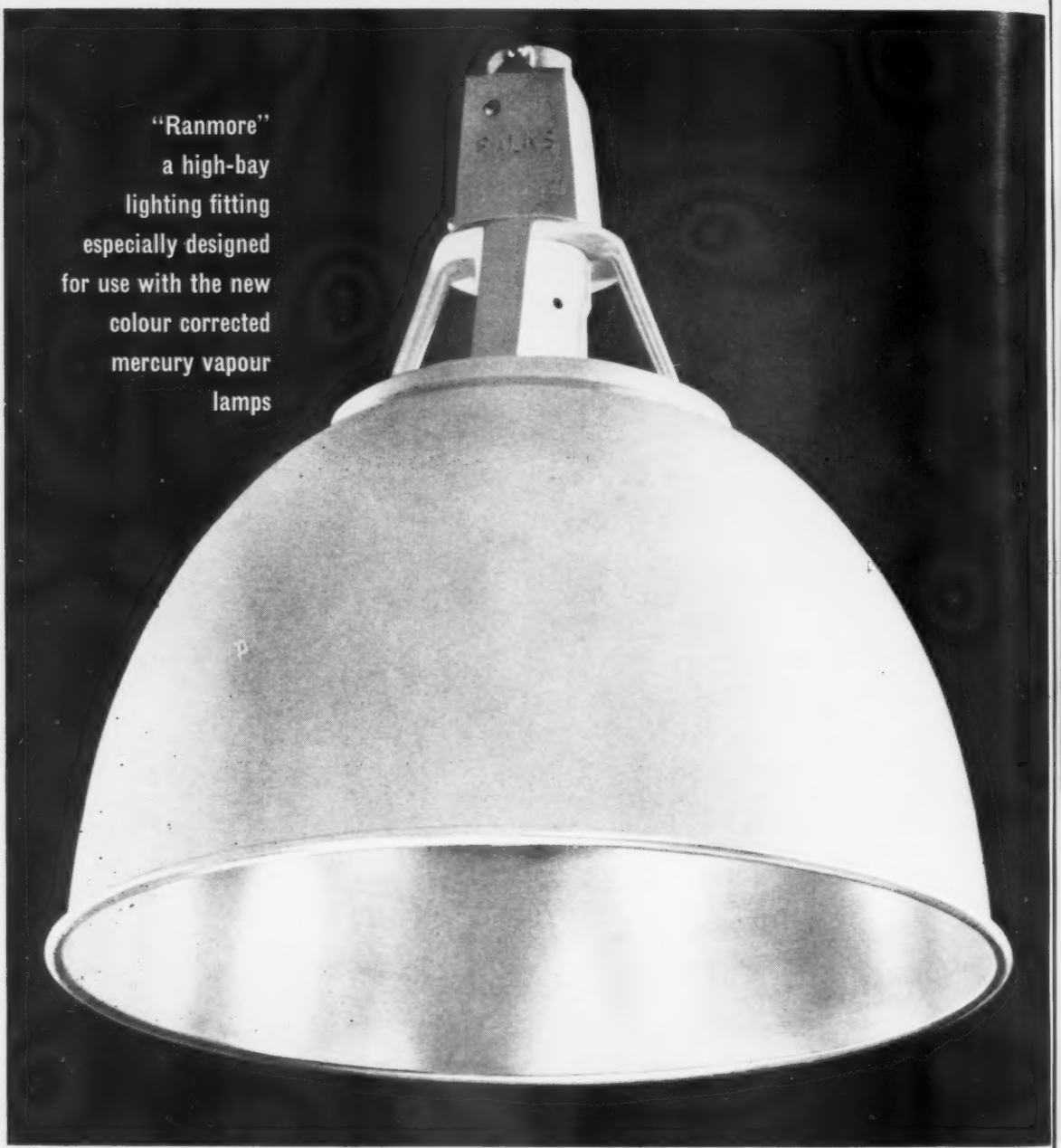

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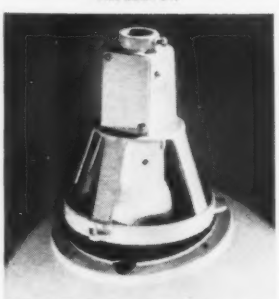

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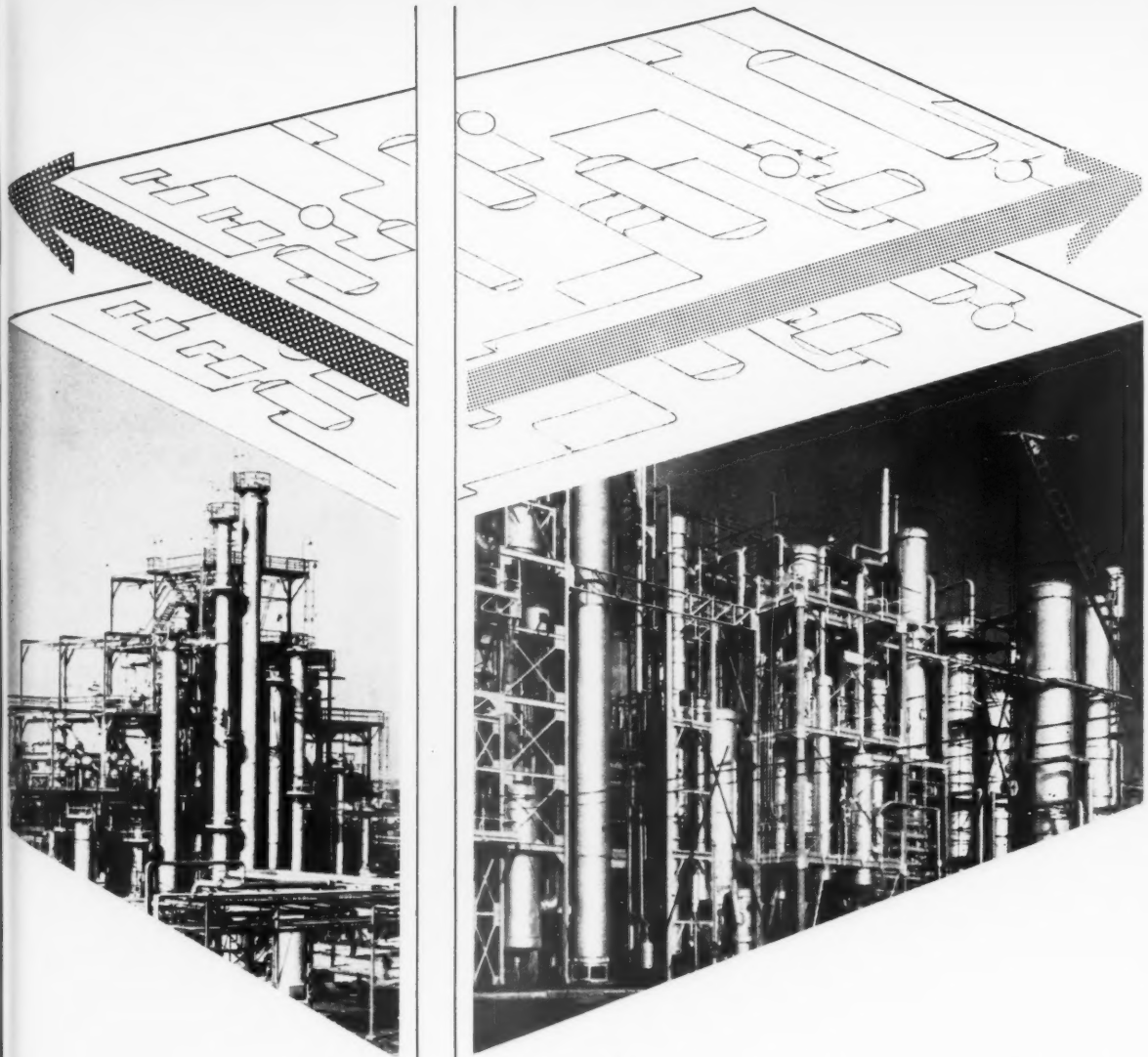

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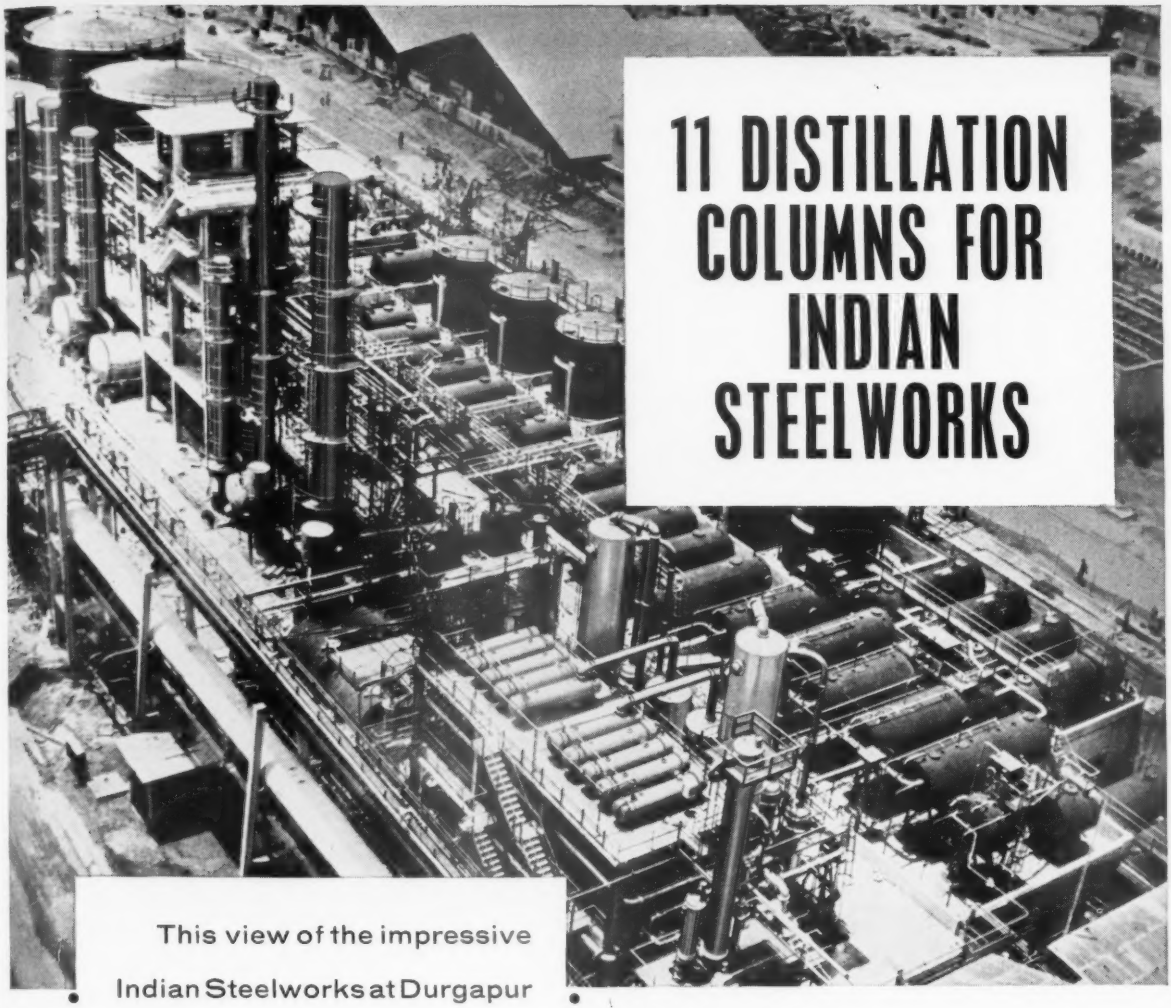

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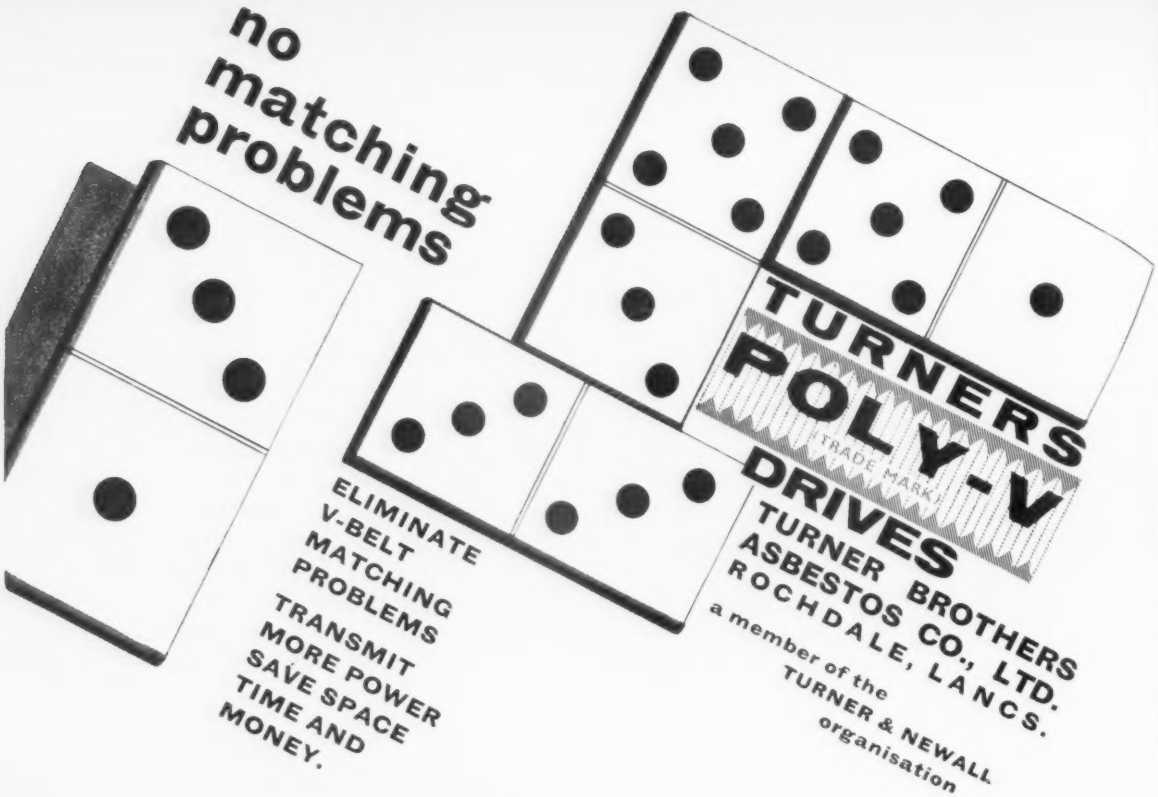

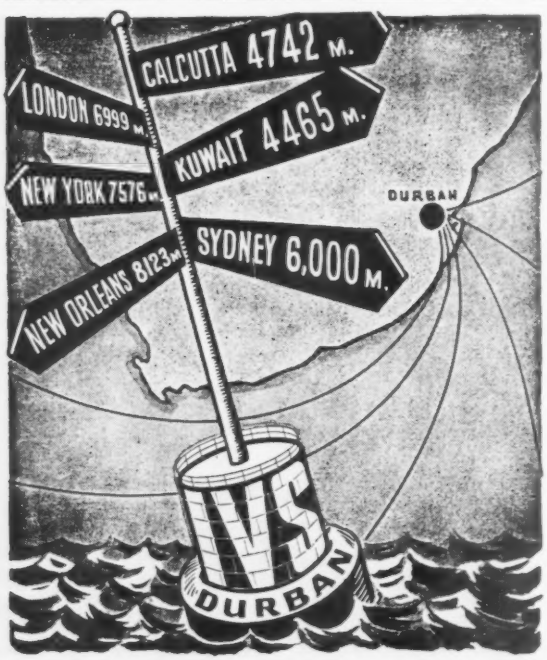

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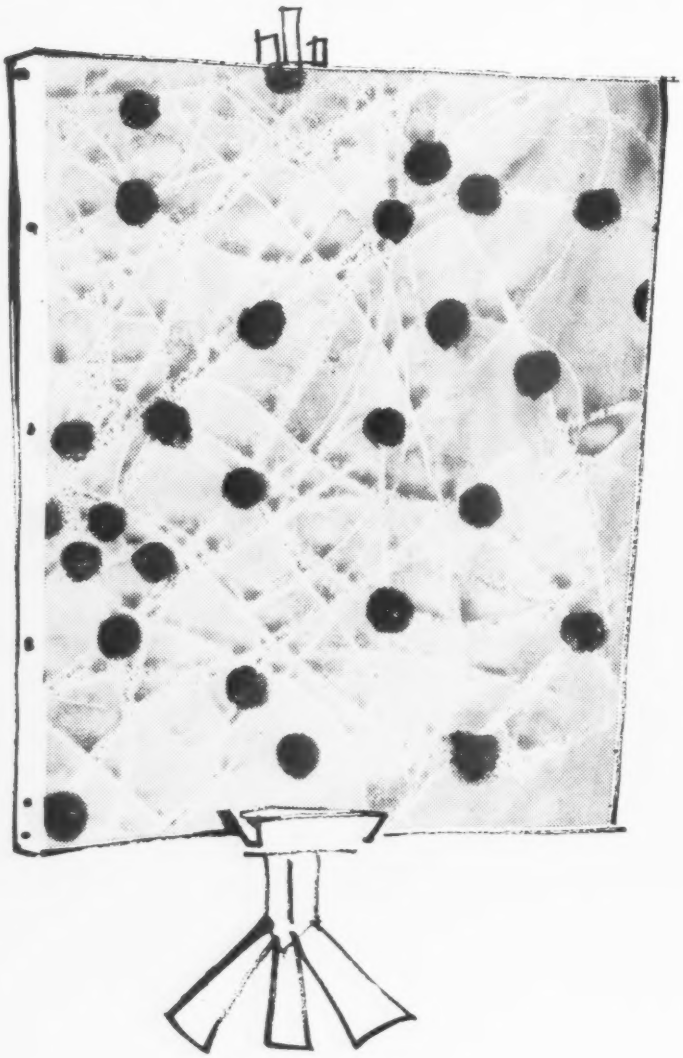

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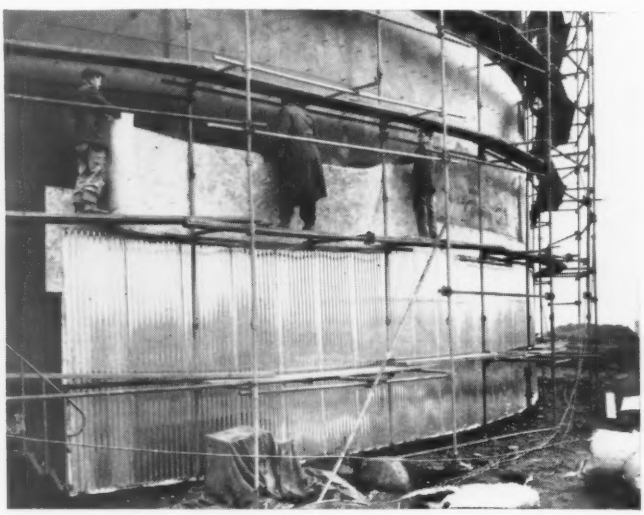

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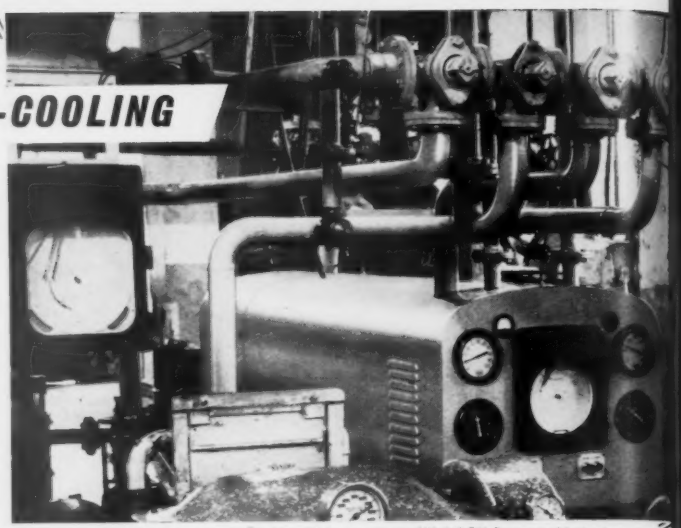

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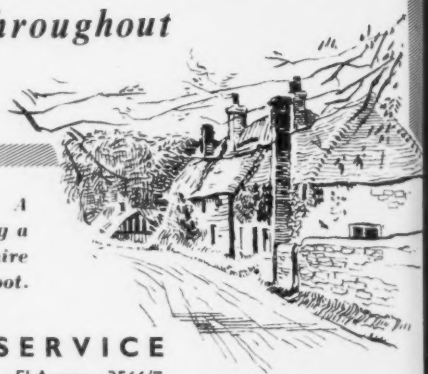

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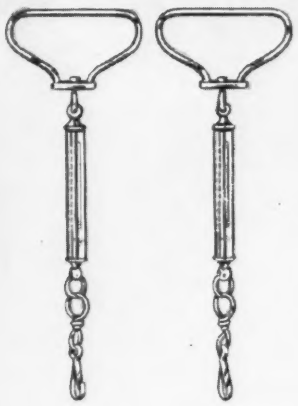

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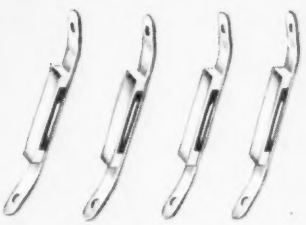

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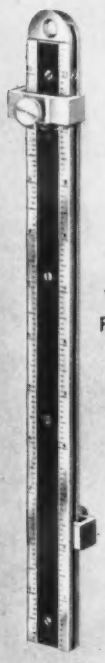

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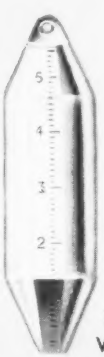

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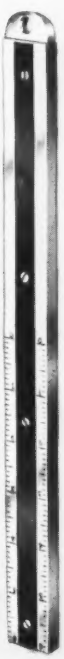

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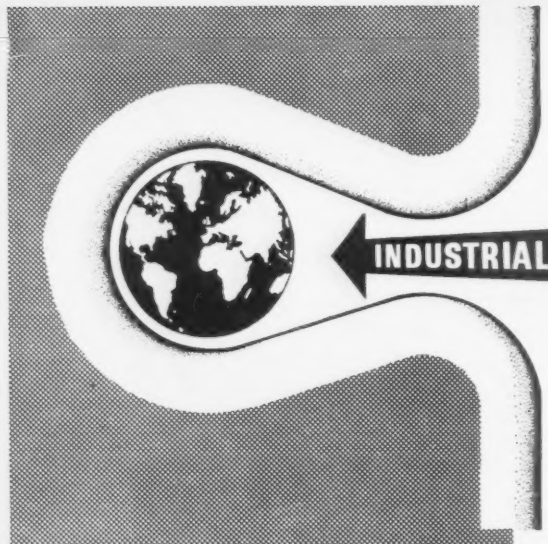

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